THE GAS JOURNAL

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A Glance at the Contents—

Leaks in Vertical Retorts.

Mr. D. J Ward, of Birmingham, deals with the treatment by hot patching of leaks in vertical retorts. [p. 677.]

Rental Superintendent Required.

Applications are invited for the position of Superintendent of the Rental Department of the Croydon Gas Company. The commencing salary is £500 per annum. [p. 686.]

"Thermal Efficiency in the Gas Industry."

This is the title of a paper by Mr. Gilbert B. Howarth, Chief Chemist to the Newcastle-upon-Tyne and Gateshead Gas Company, at a meeting of the North of England Gas Managers' Association (Auxiliary Section). [p. 671.]

Leeds University Research Fellowship.

Applications are invited, up to Dec. 17, for an Open Fellowship of £200 per annum, established by the Institution of Gas Engineers for the prosecution of post-graduate research in gas chemistry. Knowledge of fuel laboratory technique is essential to the work in hand. [p. 686.]

Maintenance of Vertical Retorts.

Mr. A. W. Elliott, Assistant Engineer and Manager to the Elland-cum-Greetland Gas Company, deals with some of the minor points which assist in the successful everyday working of vertical retorts. He refers to a setting of Dempster-Toogood retorts at the Shrewsbury Gas-Works. [p. 679.]

A New Portable Heater.

The "Tourist" is the name given to a new portable heater manufactured by Messrs. John Wright & Co. It is intended for use as an additional source of warmth which can be carried from bedroom to dressing room, bath room, &c., as required, and just plugged into the gas connection. The heater makes use of luminous flames. [p. 669.]

London Junior Association Visit Fescol, Ltd.

An interesting inspection of the works of Messrs. Fescol, Ltd., 101, Grosvenor Road, S.W. 1, was made by the London and Southern District Junior Gas Association on Wednesday, Dec. 2. The visitors were welcomed by Mr. Nicolson-Smith, the Managing Director, who, before conducting them over the works, gave an outline of the "Fescolizing" process and exhibited examples of the many and varied applications of the process. [p. 670.]

Rating of Gas Undertakings.

Mr. George Evetts criticizes the views on this subject expressed in our Editorial Notes in the "JOURNAL" for Dec. 2. [p. 662.]

Demonstrating Industrial Gas.

At a recent Engineering Exhibition in Cardiff, the Cardiff Gas Light and Coke Company had a display devoted entirely to gas appliances, &c., for trade and industrial purposes. [p. 663.]

A Progressive Public Utility.

Admiration of the great growth of the Brighton, Hove, and Worthing Gas Company was expressed at the annual dinner and dance held at the Royal Pavilion, Brighton, on Friday, by a number of local municipal government officers who were present. [p. 667.]

Glycerin Gas Drying Process.

A letter calling attention "to the fact that glycerin solutions can have lower vapour pressures than concentrated solutions of calcium chloride, and that it is therefore possible to obtain a greater humidity extraction," is published in our columns to-day. [p. 663.]

Wales and Monmouthshire Junior Association.

A Meeting of the Wales and Monmouthshire Junior Gas Association was held at the Offices of the Cardiff Gas Light and Coke Company on Saturday, Nov. 21—Mr. S. E. Brett, the President, in the chair. An interesting address was given by Mr. W. E. Benton, M.Sc., of the Research Department of Cannon Iron Foundries, Ltd., on the subject of heat losses from gas ovens. [p. 673.]

Gas-Driven Motor-Omnibuses.

According to the "Journal des Usines à Gaz," 1931, 55, 557 (Nov. 20), the demonstrations in Belgium and France of gas-driven motor vehicles have created great interest in England. At the request of a number of gas engineers in this country, M. Pignot visited London on Sept. 21 to furnish all the necessary information to an important meeting held in the offices of the National Gas Council. [p. 666.]

Glover-West Verticals at Cape Town.

When it became necessary in 1930 to increase the carbonizing capacity of the Cape Town Gas-Works it was found possible to do this on the same ground area by the reconstruction of the No. 2 retort bench by the substitution of the new model retort for the old model, by which means the gas-producing capacity of this section of the plant has been increased by 50 p.ct., equivalent to an additional daily capacity of 375,000 c.ft. [p. 668.]

EDITORIAL NOTES

Wages Agreement

JUST as we are going to press with this issue of the "JOURNAL," we are glad to learn that, after a long period of difficult and delicate negotiations, agreement has been reached by both sides of the National Joint Industrial Council with regard to the question of wages. It is a fact which cannot be gainsaid that public opinion has been for some time definitely opposed to the maintenance of the relatively high level of wages which gas workers have enjoyed undisturbed for many years. As might have been expected, public opinion has expressed itself most forcibly in this regard in those districts which have been exposed to the full effects of the economic blizzard. It has for some time been obvious that the wages of gas workers in the industrial centres whose streets are thronged with unemployed, and where wages in general are ruling at a very low level, could not be maintained.

In the course of the recent negotiations between the two sides of the National Joint Industrial Council, a review of the wages position in the Industry throughout the country has been undertaken with the greatest care, and a settlement has been reached whereby wages have been reduced in certain districts by varying amounts. It is a tribute to the employers in those districts which have been less hardly hit, and where the outlook is less black, that they have agreed, as part and parcel of the national settlement, that there should be no reduction of wages in such areas. In the other districts, the reductions have been such as to meet the particular circumstances of the case.

We do most sincerely offer our congratulations to the National Joint Industrial Council on its statesmanlike and businesslike treatment of one of the most difficult problems which the Industry has had to face during the last decade. If the Council had chosen the coward's part—ignoring realities and evading the issue of a differentiation in wage reductions—inevitably the present machinery of conciliation, discussion, and negotiation through the medium of the Joint Industrial Council would have broken down, if not at once, certainly within a few months' time. As it is, we venture to prophesy that the Council has been so strengthened and confirmed in its usefulness by the wisdom which has been displayed that it may confidently be relied upon solidly and effectually to withstand any conditions of storm or stress such as might otherwise have destroyed it.

Land Value Tax to be Repealed?

IT was rumoured in parliamentary circles last week that the provisions of the first Finance Act of 1931 with regard to the valuation and assessment of land to the new Land Value Tax would be repealed before they became operative. The first annual assessment was fixed by the Act for the fiscal year 1933-34. Statutory gas concerns and other public utility undertakings were specifically excluded (by section 24 of the Act) from the operation of the tax; but this news will be welcomed by those non-statutory companies which would otherwise have been subject to the additional impost.

A word of warning is, however, necessary. Despite numerous parliamentary questions asked in the House of Commons, the official reply is still given that this particular section of the Act is, and will remain, effective until it is amended. It it also stated that the Opposition will oppose the repeal of the tax, and it will accordingly be necessary to await the 1932 Finance Act before the position is definitely known.

It is announced in to-day's "Times" that the Government have decided to suspend the Valuation for the Land Tax.

A Miscellany

DURING the past few weeks the Junior Gas Associations have been very busy, and in this issue of the "JOURNAL" we publish abstracts of three excellent contributions at recent meetings. Two of these are concerned with vertical retort installations—Mr. D. J. Ward, of Birmingham, dealing with the hot patching of vertical retorts, and Mr. A. W. Elliott, of Elland, with their working and maintenance. The other is concerned with heat losses from gas ovens, and is by Mr. W. E. Benton, of the Research Department of Cannon Iron Foundries, Ltd. The author of this paper shows, as a result of theory, that the gas oven is essentially a scientific appliance, whatever our electrical friends may have to say about it. When electricity cost 2d. or more per unit for cooking, even an inefficient gas oven could show lower running costs than the best electrical cooker, but at a halfpenny a unit efficiency becomes a deciding factor; and Mr. Benton supplies a clear answer to the query: "How can a gas oven possibly be efficient when it has to get rid of its products of combustion?" He points out that, if efficiency is to be the deciding factor against electrical competition, then we must pay more attention to lagging, for, contrary to the views usually expressed, there is no theoretical limit to the efficiency of a gas oven. The theory outlined in this unusual contribution affords a means of obtaining the maintenance efficiencies of two ovens within three hours, and it offers an interpretation of the behaviour of gas ovens under various conditions.

Mr. Benton draws the conclusion that in a perfectly lagged oven an infinitely small supply of heat will maintain any requisite temperature. In an oven with very heavily lagged walls a minute gas-flame would be sufficient to keep the temperature constant, and hence a minute volume of products would be formed, requiring an extremely small flue for ventilation. There is one condition attached to these results—namely, that the temperature of the oven should not of itself give rise to an aerodynamic force tending to ventilate the oven, a condition which limits us to the consideration of ovens with bottom flues. We therefore see that, whereas the question of our electrical friends calls up a mental picture of a large and inevitable wastage of heat, the truth is that, if we lost no heat through the walls, we should lose none through the flue, and only as lagging is diminished does the flue loss rise.

It was only recently that Mr. Elliott arrived in Elland, to take up the post of Assistant Engineer and Manager to the local Gas Company, and his paper relates to the plant at the works of the Shrewsbury Gas Company, with whom he was previously employed. This plant is a Dempster-Toogood setting of vertical retorts; and it is not inappropriate that he should now be at Elland—the town where the setting originated. His paper is largely concerned with the maintenance of the best conditions in the producer, though he has a good deal to say about the flexibility of vertical retorts. Regarding producer practice, his idea is clear enough—that excess water on the producer grate is more serious than the effect of

higher temperatures in the producer itself. Carbon monoxide and hydrogen is his creed—not hydrogen and carbon dioxide. And as for the flexibility of continuous verticals, hark to the following: "During the early part of 1930, great difficulty was experienced in keeping the coke customers supplied. In the winter time, the coal gas was supplemented by about 15 to 20 p.ct. of carburetted water gas of the same calorific value—460 B.Th.U. To increase the production of coke, the throughput of coal in the verticals was increased from 4·1 to 5·1 tons per retort per day, steaming was reduced, and the resulting gas averaged 485 B.Th.U. calorific value. This was diluted by making blue water gas with the water gas plant. Although the make per ton of coal gas was reduced from 19,500 to 16,900 c.ft., the thermal yield per retort was increased by 12½ p.ct. All oil and some coke were saved on the water gas plant, and the total make of coke was increased by nearly 25 p.ct."

Hot Patching

We are particularly interested in the contribution by Mr. Ward because he demonstrates so clearly that those in charge of vertical retorts simply cannot afford *not* to hot patch—provided, of course, that this hot patching is carried out efficiently. The point is that, though hot patching will not permanently stop leaks, it will so retard them as to enable retorts to run for one or one-and-a-half years longer than if no patching were practised. Also, hot patching should be used in conjunction with spraying and cold repair to keep refractory work in really good condition. The paper which Mr. Ward presented to the Midland Junior Gas Association is an abstract of a thesis for which he was awarded a Diploma of the Institution of Gas Engineers; and there are many points in it which are well worthy of more than casual notice. His remarks on the spraying of leaking retort faces, for instance, are important. Spraying with suitable cement mixed to a thin grout, he explains, was tried for the purpose of stopping holes in the brickwork, but unless these were of the smallest character, this practice was found useless, because, first, it is dangerous to spray cold grout on to red hot silica for the necessary length of time; secondly, much of the retort face which is not of a leaky nature is necessarily sprayed; and, thirdly, it is difficult to work with a grout of suitable thickness, on account of pipe and spray blockage. Hot patching by guns was resorted to, but the cartridge type, fired either by the heat of the retorts or by trigger percussion, was not found satisfactory. Hence a compressed air gun was designed, which proved both speedy and effective; and the author's detailed description of this device, and the method of working it, will prove of great practical value.

From the general viewpoint, Mr. Ward's analysis of the relative virtues of hot patching and cold repairs is, we think, the most important section of his admirable contribution. Hot patching, he emphasizes, cannot be considered as a definite or permanent cure for leaks in vertical retorts. Its usefulness depends on the extra time it will keep retorts in good condition before the inevitable letting-down for cold repair and pointing. This may be taken as 12 or 14 months. Therefore, to get a fair estimate of the relative costs, cold repair alone must be taken as against cold repair combined with hot patching. The author takes a period of six years, at the end of which time the retorts would be in approximately the same condition; and, with 44 retorts in a range, Mr. Ward states that the annual saving in favour of hot patching and one cold repair, as distinct from no hot patching and two cold repairs, amounts to 0·037d. per 1000 c.ft., or 0·008d. per therm.

A Good Resolution

Times have changed for the Woolwich Borough Council. When the Labour Party had a majority on the Council, a report was presented (and adjourned for further consideration) by the Housing Committee, to the effect that "they were requesting the Electricity Committee to install an electric cooker in every house to be erected on the new [Middle Park, Eltham] estate, this cooker to be hired by the tenant from the Electricity Department at a weekly charge. As the Council had decided that the houses should be electrically equipped and provided with a combination range downstairs, and with a fireplace in one of the bedrooms, no gas would be allowed in the houses. The Committee recommended that clauses be inserted in the tenancy agreements for the houses on the estate to this effect." Last Wednesday, when the report came up again, a debate lasting more than three hours ensued, at the end of which it was decided to allow gas to be used for all purposes in these houses. Upon this sign of enlightenment the Woolwich Council are to be congratulated. They are thus following in the footsteps of the London County Council, who some months ago made a ruling to the effect that tenants should be allowed freedom of choice in the matter of the type of heating and cooking they desired in their own homes. So much for the principle now adopted at Woolwich.

In addition, however, to this vital point, certain members of the Council during the proceedings made statements which may be placed on record, if only to show how essential it is from a material point of view that Council House tenants—whose means presumably are modest—should have this freedom of choice apart altogether from the moral aspect. Mr. Barefoot, the leader of the Labour Party, referring to statements as to excessively high cost of electricity on the estate, said that "the average cost per house was only 3s. 10d. a week, or, for the all-electric type, of which there were 386 houses, 4s. 2·298d. a week, and not the fancy 10s., 12s., or even 15s. a week they had heard about." There is a suggestion of precision about the three places of decimals which should be convincing, but is not. For later in the debate we have Mr. Rolstone saying that "he had been in a house on the Council's Page Estate where 9s. a week was being paid for electricity, and yet there was not the heat required for the family. He knew of other houses where the radiators were wrong, and the men sat in front of them with their overcoats on. They were charging for electricity a figure which it was impossible for many of the individuals to pay, and in some cases the tenants were not able to use their parlours during the winter." Just prior to this, Mr. Campbell had declared that he had a statement by the Borough Surveyor to the effect that several of the tenants "were paying for electricity as much as 10s. a week."

A common-sense view was expressed by Alderman Lister, in the remark that "their tenants were not fools, and that if it could be proved to them that electricity was cheaper than gas, they would use the electricity." Why should not every municipal electricity undertaking be willing—nay, eager—to do business upon this basis?

Unemployment Grants

In the Editorial Columns of the "Journal" for Nov. 5 and 19, 1930, we remarked on the decision of the Court of Appeal that Treasury Grants approved by the Unemployment Grants Committee are not in the nature of income subject to assessment to income-tax. While the Emergency Budget provided for the reduction of these grants to local authorities (at an estimated saving of £500,000 for the next fiscal year), and at least one large gas company has recently announced that it is not proposed to expend the full amount approved by the Unemployment Grants Committee, it is gratifying to be able to record that the House of Lords have finally settled the point at issue by affirming the decision of the Court of Appeal. It is noteworthy that the appeal of the Commissioners of Inland Revenue was dismissed without Counsel for the Seaham Harbour Dock Company being called upon to answer for the Respondents, and thus a two years' contest with the Somerset House Authorities has been decided in favour of the taxpayer by the supreme tribunal of the English Courts.

The respondents are to be congratulated on their tenacity of purpose, which has enabled this case to establish a principle of far-reaching effect; and we are only regretful that present conditions necessitate such protracted and costly proceedings for the subject to secure this result.

PERSONAL

SIR FRANCIS GOODENOUGH.

The news in a paragraph in to-day's "JOURNAL" that Sir Francis Goodenough has had to cancel the delivering of his Presidential Address to the Illuminating Engineering Society which was fixed for Dec. 11 reveals a condition regarding which he has our sympathy. Sir Francis contracted a chill towards the end of his American visit, and although he shook off the chill it left a persistent catarrh which caused him much trouble and reduced his vitality. Anxious to get back to full working capacity, Sir Francis consulted a specialist, and was having operations on his nose when he unfortunately contracted influenza which settled in the nose and throat, and set up a serious condition of ulceration. The grave risk of septic pneumonia was fortunately overcome, and Sir Francis is now steadily recovering from the conditions set up by the influenza. His doctor insists upon complete rest for the present, and Sir Francis has cancelled all his present engagements, but he has every hope of being able to resume work fully restored to health by the end of the year.

MR. JOHN TERRACE.

We regret to hear that the hopes formed when Mr. John Terrace, M.Inst.C.E., Chief Engineer of the South Suburban Gas Company, was given leave of absence to seek restoration of health through a sea voyage have not been realized, and Mr. Terrace has now, at his request, been placed upon the retired list. His services have been retained to act in a consultative capacity in such technical matters as his assistance may be desired.

The many friends of Mr. Terrace in technical circles will join with us in hoping that his relinquishment of the arduous duties connected with a large gas undertaking will allow him to take the rest so essential to his complete recovery of health. The position of Engineer has been filled by the appointment of Mr. F. G. GORMAN, Assoc.M.Inst.C.E., formerly Chief Assistant.

The Directors of the Gas Light and Coke Company have made the following official appointments, to date from Jan. 1 next: Mr. H. M. ROYLE to be in charge of the Southend Works; and Mr. J. H. HORNBY to be in charge of the Brentwood Works.

Mr. T. H. ATKINSON, Fittings Foreman, Halifax Corporation Gas Department, has been appointed Distribution Superintendent to the Rossendale Union Gas Company.

Mr. W. J. SHELLEY, Chief Chemist and Technical Assistant at the Walsall Corporation Gas-Works, has been appointed Assistant Engineer and Manager of the Hinckley Urban District Council's Gas-Works.

On his retirement from the staff of the University of Birmingham, the title of Emeritus Professor has been conferred upon FREDERICK WILLIAM BURSTALL, for over 30 years Professor of Mechanical Engineering. The Professor has on several occasions lectured before Societies connected with the Gas Industry.

A presentation was made at the Gas Meter Testing Station, Manchester, to Mr. A. C. NEWTON, who is leaving the Manchester office to take up the duties of Official Inspector for the County Borough of Oldham, in succession to the late Mr. Geo. Kay. Mr. A. Winterbottom, Official Inspector at Manchester; Mr. F. Colburn, Official Inspector at Birmingham; Mr. E. Simpson, Official Inspector at Salford; and now Mr. A. C. Newton, Official Inspector at Oldham, were all colleagues together under the late Mr. S. Dyson, of Manchester.

Mr. JOSEPH H. RACE, B.Sc., of Burnley, has been appointed Engineer and Manager to the Farnworth and Kearsley Gas Company. Mr. Race, who was educated at Manchester University, has held appointments with the Liverpool Gas Company, the Bishop Auckland Gas Company, and the Sunderland Gas Company. Mr. FRANK B. ALLEN has been appointed Secretary to the Company.

An honorarium of £300 is to be paid by Elgin Town Council to Mr. PETER LOW, Gas Manager, in respect of his services in connection with the erection of the new gas-works. Mr. Low was responsible for the whole scheme, which cost £40,000, and was described in the "JOURNAL" for Oct. 28.

CORRESPONDENCE

Rating of Gas Undertakings

SIR,—I have read with very great interest Mr. J. Harger Pye's paper on the above subject and your editorial in the "JOURNAL" of Dec. 2.

There are two points in your editorial to which I would refer: You state that the suggestion that part of the cost of maintenance and renewals of a works should be transferred from the landlord to the tenant has been put forward in only one case, and cannot therefore be seriously considered.

I cannot agree with this statement. I know many cases where it has been put forward, and in the majority of cases acted upon in making the valuation. If you mean that it has only been put forward at one Quarter Sessions case, and then unsuccessfully, I cannot challenge the statement, because I have not followed these cases. At the same time, however, if this is so, I cannot understand on what grounds the claim was unsuccessful. In my opinion section 22 (1) of the Rating and Valuation Act is clear. Paragraph (*a*) of this sub-section states that in cases of property specified in Part I. of the 2nd Schedule the repairs shall be deducted from the gross to get the net, and paragraph (*b*) states that where properties do not fall under the description in Part I. of the 2nd Schedule then the rent is to be estimated on the basis of the tenant undertaking to bear the cost of repairs, insurance, and other expenses.

Whatever may be the opinion on this point, however, you are wrong in differing from the author of the paper in the deduction which he draws from this alteration. The inclusion of the statutable deductions in the tenant's capital *does* decrease the rateable value if one is to follow rigidly the original methods. The mere fact that the hypothetical tenant is to be allowed 15 p.ct. or 17½ p.ct. on a new element of expenditure automatically decreases the rateable value. An expenditure which has always previously been considered as landlord's now becomes tenant's. If the tenant is to provide further capital to carry out such repairs, then the net profit remains unaltered, but the tenant gets an allowance of 15 p.ct. on a larger sum than he did before; and seeing that this allowance is deducted before the net rateable value is arrived at, the bigger the allowance the lower net rateable value.

To push the matter to an extreme, if all the expenditure on revenue account were to be regarded as tenant's, the tenant would require more floating capital than hitherto and would get a bigger allowance before the net annual value is arrived at.

While on this subject, however, I would like to say that some rating surveyors will not admit that the words referred to in the Act should increase the tenant's capital. They only say that it relieves them of the task of calculating a gross as well as a net value.

With reference to the last paragraph of your editorial, with all respect I do not think the inclusion of the receipts from residual products should make any difference to the rateable value either theoretically or practically. A tenant wants a certain amount of floating capital to run the undertaking. If his receipts from residual products come in more regularly than his receipts from gas, then he gathers the money in quicker, and so helps to pay for his coal bill. It ought not to make any difference to the amount of the tenant's floating capital whether you count the receipts from residual products in with the gas receipts or not. Of course, if you are rigidly going to take a certain definite proportion of your expenditure as a necessary figure for floating capital, then the gross coals figure will suit you very much better than the net coals figure. But no wide-awake surveyor is going blindly to accept the same proportion whether or no residual products are taken in to the computation. It is entirely a question of adequacy.

GEO. EVETTS.

Palace Chambers, Bridge Street,
Westminster, S.W. 1,
Dec. 7, 1931.

SIR,—I should like to express my thanks for the helpful criticism of the paper on the above subject which appeared in the Editorial Notes in your issue of Dec. 2.

With regard, however, to your remarks on section 22 of

the Rating and Valuation Act of 1922, I should like to point out that, if my interpretation of the 1922 Act be correct, and the tenant "bears the cost of the repairs and insurance and other expenses necessary to maintain the hereditament in a state to command that rent," these costs must be included in the working expenses although they are deleted from the "statutory deductions."

This would result in a lower assessment, as the tenant would get 15 p.ct. or 17½ p.ct., as the case may be, on a proportion (say, ⅔) of the increased working expenses, as well as obtaining the full allowance in his working expenses, of the repairs, &c., which previous to the 1922 Act were not included in working expenses but deducted from the gross assessment as statutable deductions.

From your remarks and other information received it appears probable that my interpretation of section 22 of the Rating and Valuation Act, 1922, is not correct; and if this be so it may be advisable to retain the statutable deductions as before. To my mind, however, the wording of the act is perfectly clear in stating that the tenant shall bear the cost of repairs, &c.—*i.e.*, that they should be included in working expenses and not in the landlords' deduction (statutable deduction).

JOS. HARGER PYE.

Gas-Works, Clevedon,
Dec. 4, 1931.

Glycerin Gas Drying Process

SIR,—We have read the paper given by Messrs. Hawes and Wadsworth which appears in your issue of the 2nd inst., and we cannot help feeling that Mr. Hawes might have made some attempt to gain a little more information about the use of glycerin for gas drying before expressing his personal opinions. We should have thought that, before reading a paper at a scientific meeting, he would have done this for his own benefit, and had he written to us for information we should have been delighted to enlighten him.

We have previously drawn attention to the fact that glycerin solutions can have lower vapour pressures than concentrated solutions of calcium chloride, and that it is therefore possible to obtain a greater humidity extraction. There is a greater working margin. This is clearly shown by the Duhring lines, and it is confirmed by laboratory experiment.

With regard to the pumping costs, we think that, had Mr. Hawes taken the trouble to make a little calculation, he would have realized that to pump a few tons of glycerin through a distance of a few feet every 24 hours or so, could only be a trivial matter.

F. W. STOKES,
Managing Director.

Kirkham, Hulett, & Chandler, Ltd.,
Norfolk House, Norfolk Street,
London, W.C. 2,
Dec. 7, 1931.

Gas Salesman's Pocket Book, 1932.

It can fairly be said that the Gas Salesman's Pocket Book offers in compact form the most accurate information on the technical aspects of gas salesmanship which is available to the Gas Industry. Many years' careful work, based upon first-hand experience of what the salesman and the fitter need in their daily tasks, has resulted in a standard reference book containing much exclusive matter. It does not take long for a technical work, once published, to become out-of-date in certain particulars, such is the advance of science in any industry. The Gas Industry is no exception to the general rule; and this makes it most desirable—indeed, necessary—to have constant revision of technical data. The publication annually of the Salesman's Pocket Book ensures this.

Subscribers to the 1932 edition will appreciate the extent of the revision which has been effected in the Pocket Book, and they will doubtless appreciate too the alterations in the make-up of this salesman's guide and help—the more opaque paper, in the interests of legibility, is one example. But we are concerned here particularly with the information, which is essentially "1932 information," with its sections on floodlighting, street lighting, and with its largely extended section on the industrial uses of gas. There is no need to catalogue the many improvements, though perhaps special reference may be made to the new form in which the consumptions of all gas appliances, including refrigerators, flueless heaters, and storage water heaters, are set out—a change which should prove of the greatest assistance to the thousands of salesmen and fitters who now make use of the Pocket Book.

The Gas Salesman's Pocket Book for 1932, edited by Norman S. Smith, B.Sc., Assoc.M.Inst.Gas E., is now available at the "GAS JOURNAL" and "Gas Salesman" Offices, No. 11, Bolt Court, Fleet Street, E.C. 4, price 3s. 6d. net, or 2s. 9d. each for 24 copies and over.

Forthcoming Engagements.

Dec. 12.—YORKSHIRE JUNIOR ASSOCIATION.—Meeting at Bradford. Paper by Mr. J. H. Bingham on "Dry Gas Meter Design."

Dec. 16.—SOUTHERN ASSOCIATION OF GAS ENGINEERS AND MANAGERS (EASTERN DISTRICT).—Meeting.

Dec. 17.—SOCIETY OF BRITISH GAS INDUSTRIES.—Council Meeting in the afternoon.

Demonstrating Industrial Gas

This is a photograph of the display of the Cardiff Gas Light and Coke Company at the Engineering Exhibition, Greyfriars Hall, Cardiff, held under the auspices of the South Wales Institute of Engineers. As can be seen, the exhibit is devoted entirely to gas appliances, &c., for trade and industrial purposes. The furnaces were at work with high and low pressure gas, and a number of tests were carried out on the stand for engineers and others who were particularly interested in seeing the processes to which gas is applicable for engineering work. Industrial graded coke was also shown. This was the best lighted stand at the Exhibition, and it proved exceedingly attractive to a very large crowd of visitors during its ten days' run.

IN CONTINENTAL COUNTRIES - - -

Abstract Translations from the Technical Press of France and Germany.

APPLICATION OF GAS IN THE DRYING OF WASHING.

The various possibilities of drying washing are considered, on the basis of experimental evidence, by Dr. Schumacher in "Das Gas- und Wasserbach," 1931, 74, 1049—1052 (Nov. 14) and 1084—1092 (Nov. 21), in an article containing numerous graphs and tables. Three methods are possible when gas is employed.

(*a*) Hand-wringing followed by oven drying and ironing by hand.

(*b*) Hydro-extraction followed by oven drying and ironing by hand.

(*c*) Hydro-extraction followed by a finishing mechanical ironing between heated rolls.

Hand-wringing and mechanical wringing are compared with hydro-extraction from the point of view of the number of man-hours required and the degree of water removal effected. The further drying of the goods in ovens is dealt with for the alternative systems of using indirectly heated air or combustion products diluted with a large excess of air (direct heating). The latter is cheaper. With indirect heating and with gas of calorific value 470 B.Th.U. per c.ft., 8·8—9·6 c.ft. of gas, or 4140—4500 B.Th.U., are required for each pound of water removed. Of the heat, about 72 p.ct. is supplied to the drying oven, the remainder being contained in the waste gas. On the assumption that 1 lb. of water requires for evaporation 1080 B.Th.U., 25 p.ct. of the actual heat input is actually used in evaporation of water. With direct heating, 6·1—6·4 c.ft. of gas, or 2870—3000 B.Th.U., is required for each pound of water removed, and 37 p.ct. of the heat input is actually used for evaporation of water.

The importance of proper design in drying ovens is emphasized, since, if the distribution of the washing in relation to the air flow is not at its best, the efficiency will be lowered. Burners must be designed with due consideration to the drying time, the temperature of the outgoing air, and the amount of gas employed per unit volume of useful drying space. In the case of direct heating, a CO_2 content as high as 1·2—1·5 p.ct. in the outgoing air is permissible, and the exit temperature of the air may be as high as 158° Fahr. if the degree of saturation is low. With uniform distribution of the heat over the horizontal cross-section of an oven, the heat input per cubic foot of useful drying space may be as high as 506—618 B.Th.U. per c.ft. per hour, equivalent to 1·08—1·3 c.ft. of 470 B.Th.U. gas per c.ft. per hour. For each cubic foot of available drying space, the volume of warm outgoing moist air will be about 70 c.ft. per hour, and an offtake area of cross-section equal to 0·5 sq. in. per c.ft. of available drying space is necessary for the evacuation of the air. The walls must be well insulated. Thermostatic control and thermometers should be provided.

As regards ironing, the ratio of the weight of residual water to that of the dry articles must not be too high, before ironing—namely only about 0·14 to 0·24 in the case of hand-irons, though it may be as much as 0·6 in the case of mechanical ironing. The latter figure corresponds with the amount of water left in the washing when hydro-extractors are employed. Gas-heated hand-irons were found to require 6·4—8·8 and mechanical ironing 4·5 c.ft. of 470 B.Th.U. gas per lb. of water evaporated. In the case of mechanical ironing, it is necessary to allow a pause between passing through consecutive articles, to prevent the rolls from cooling down too much.

For sheet goods, the best combination is the use of hydro-extractors followed by finishing by mechanical ironing, whereas with other articles, hydro-extraction followed by oven drying and hand ironing is the best.

Consideration is given to the equipment adapted to be run by one person, and though this is too expensive for individual households, co-operative installations could be run very economically and effect much saving in time. At the same time, the gas undertakings would derive benefit.

REVIEWS

THE YORKSHIRE, NOTTINGHAMSHIRE, AND DERBYSHIRE COALFIELD (SOUTH YORKSHIRE AREA).

ANALYSIS OF COMMERCIAL GRADES OF COAL—PART I.*

Considerable and valuable progress is being made in the excellent work of the Fuel Research Division concerned with the preparation of the Special Survey Papers and reports on matters connected with the physical and chemical survey of the coal seams of Great Britain.

The thoroughness with which this work is being carried out is particularly noticeable in the case of the coalfield which is the subject of this review. It is well worth recapitulating here briefly the publications in this series which have already dealt with this valuable area: Survey Paper No. 1 was a general correlation of data for this coalfield, Nos. 13 and 17 dealt with the Parkgate seam, No. 18 with the Barnsley seam, and the latest publication, No. 20, is the first part of a paper dealing with the analysis of commercial grades of coal derived from the Halifax Soft, Silkstone, Parkgate, Swallowwood (or Haigh Moor), Barnsley (or Top Hard), High Hazels (or Kent's Thick), Wathwood (or Meltonfield), and the Shafton seams. They range in types from coals that are capable of producing excellent metallurgical coke, and from excellent gas producing coals, to those that are almost non-coking and which find their main outlet in steam raising and in domestic use.

The paper represents a colossal amount of work; apart from the collection and preparation of the samples, some 230 analyses are recorded, including for the more valuable specimens ultimate analyses, Grey-King laboratory carbonization assays at 600° C. as well as phosphorus and chloride determinations.

A departure from usual custom is that the cokes resulting from the carbonization assays are characterized as of types *a*, b_1, b_2, or *c*, a rather broad classification, photographs of representative types of these cokes being reproduced in the plate at the end of the report. These four types of assay cokes are described thus:

(*a*) Those which are much swollen and occupy a considerably greater volume than the original coal.

(b_1) Those which occupy a smaller volume and are hard.

(b_2) Those which occupy a smaller volume and are soft.

(*c*) Those which occupy a greater volume than the original coal but are not so swollen as type (*a*) and are in general much harder.

A criticism which might be offered at this method of characterization of coking coals is to question why such a low temperature as 600° C. should be used in the carbonization assay, a temperature so considerably lower than those at which any of the industrial processes operate in the utilization of these coals. At least it would not appear unreasonable to expect the inclusion of some reliable conversion factor which would translate the assay figures into yields obtainable in modern industrial practice.

From a general consideration of the whole of the data we would say that from the point of view of the carbonization industries, coals "*c*" would be the most suitable to use in modern gas-works installations; coals "*a*" would make the best coking coals (for coke production), while "b_1" and "b_2" are generally inferior for either purpose.

With regard to the reproduction of the subject matter of the report, consisting of some 40 sections, it will be observed that the majority of these sections (each representing the examination of the products of a particular colliery) each occupy one page and two quarters or halves. It would have made reference considerably easier and the paper on the whole more pleasing if each of these sections had been commenced on a fresh page and had been arranged to occupy two (or occasionally four) facing pages; the occasional blank page or portion of a page would prove

* Department of Scientific and Industrial Research. Fuel Research, Physical and Chemical Survey of the National Coal Resources, No. 20, H.M. Stationery Office, London, 1931. Pp. VI. + 73 and 1 plate; price, 1s. 3d. net.

useful for adding subsequent analyses, personal notes, remarks or references.

On the whole, however, this report, as well as the others of the series which have been referred to above, should prove extraordinarily useful to all who are connected with the production, utilization, or study of the coals from this valuable coalfield. "TAMBT."

CONVERTING A BUSINESS INTO A PRIVATE COMPANY.

The ninth edition of this little book by Herbert W. Jordan, published by Jordan & Sons, Ltd., of Chancery Lane, W.C. 2, at 1s. 6d. net, like the previous editions, sets out to answer in a comprehensive yet interesting way the question so frequently asked the proprietors of old-established businesses by their friends, "Why do you not turn your business into a Private Company?" The author deals in turn with the formation of a company, and the cost of that formation, memorandum and articles of association, the transfer of business to company, and obtaining additional capital.

A final table indicates the duties and fees payable on registration of a private company. In the total are included the deed stamps of 10s. each payable on the memorandum and articles and the fee stamps of 5s. which have to be impressed on the articles, and a number of documents, together amounting to £2.

In the publication an endeavour is made to show the steps taken from the time the owner of a business has arrived at the decision to form a company until the completion of the transfer of the business to the company, it being only necessary subsequently to lodge with the Registrar of Companies annual returns and certain other documents according to circumstances.

PROFIT-SHARING AND CO-PARTNERSHIP.

The third edition of "Profit-Sharing and Co-Partnership" has just been published by the Industrial Co-Partnership Association, 1, Gordon Square, W.C. 1 (price, 6d.).

In a foreword, Mr. Ernest W. Mundy, B.A., Secretary of the Industrial Co-Partnership Association, remarks that the booklet forms an attempt to set out briefly some of the main ideas connected with the principle of co-partnership.

The whole booklet has been revised and brought up-to-date, and new information has been added. Some of the chapter headings give a good indication of the subjects covered by the book—the general principle and practice of co-partnership; cash profit-sharing; capital holding by employees; co-partnership schemes; works councils; employee directors; and so forth. In endeavouring to set out the results of co-partnership it is stated that it creates a new environment in industry which will lead to the greatest possible development of every boy and girl who enters its service. The production of noble citizens will be the main object, and in achieving this a far higher output of material wealth than is yet dreamed of will be produced as a bye-product.

THE CHEMISTRY OF COALS.*

That the chemistry of coal is assuming increasing importance is apparent from the fact that two books on the subject have been published in Germany within a short space of time. A great deal of work on the subject has been carried out within recent years, and it is now possible to survey the progress which has been made and to obtain ideas for further investigations which will fill the many gaps which still remain. Such work cannot fail to lead to important progress in fuel technology.

The present volume is concerned mainly with coal and differs, therefore, from Fuchs' recent book which, in addition, covered peat and lignite very fully. The treatment is along conventional lines, but the author has been able to draw much material from the results of his studies of the Siberian coals. One of the largest sections of the book is devoted to the question of tar and its formation, both as a result of low-temperature and high-temperature carbonization. This provides much useful information presented in an interesting manner and will well repay reading.

* "Die Chemie der Kohlen," by Prof. G Stadnikoff. Stuttgart, 1931, Ferdinand Enke. Pp. XII. + 340; price R.M. 19 unbound, R.M. 21 bound.

THE NEWS OF THE WEEK

The Llandudno Urban Council are applying for sanction to borrow £10,000 for expenditure incurred and anticipated in the provision of gas cookers and meters.

Large New Gas-Works have recently been completed at Dijon by La Société du Gaz et Eaux. The initial installation has a production capacity of 2,118,000 c.ft. per day.

We Learn with Regret from the Secretary (Mr. J. S. Dow) that the meeting of the Illuminating Engineering Society next Friday at which Sir Francis Goodenough was to have delivered his Presidential Address has been cancelled owing to the unfortunate indisposition of Sir Francis.

Gift of Medical Gas Lamp.—At a recent meeting of the Belfast Corporation Gas Committee reference was made to the paper which Sir Leonard Hill read at the Exeter Conference of the B.C.G.A. The Committee directed that one of the gas lamps mentioned in the paper should be presented to the Tuberculosis Committee for use in one of the Corporation clinics.

Income-Tax Liability.—The Directors of Messrs. Falk, Stadelmann, & Co., Ltd., have decided to sanction the advance of the amount (or such portion as may be required) of the first instalment of 75 p.ct. due under Schedule "E," to members of the Company's staff who are in receipt of salaries not exceeding £750 per annum. Repayment will be accepted in 24 weekly instalments (10d. per £1 per week), or, in the case of monthly salaries, in six monthly instalments (3s. 4d. per £1 per month), commencing on the first pay-day in January, 1932.

Marsden (Yorkshire) Urban District Council have agreed to a scheme increasing the discount to consumers who pay within a month, from 5d. to 7½d. per 1000 c.ft., dating from the December quarter, subject to review at the end of the March quarter. It has also been agreed to reduce the charge for gas for public lighting from 4s. 3d. to 3s. 9d. per 1000 c.ft. for the period April 1, 1931, to March 31, 1932.

The Shop-Front Lighting Scheme in Newbury has proved very popular with the local tradesmen, and 40 gas lamps have already been fitted for the exterior illumination of 17 shops, and 8 orders are in hand for a further 20 lamps. General appreciation has been expressed on all sides, and in four cases the introduction of gas for outside lighting has led to the Council obtaining the order for the whole of the interior lighting.

Thousands of Women look forward every year to their presentation copy of a practical booklet dealing with the preparation of "Christmas Fare." This book is published by the British Commercial Gas Association, and is distributed by the gas undertakings to their consumers as a Christmas message of good will. We have just received a copy of this year's issue, which is as attractive as ever, with a delightful three-colour cover. The contents should be appreciated by every woman at this time when the worry of Christmas preparations so often makes her wish that Christmas were over. Especially will it be welcomed by all housewives in this year of financial stress. Care has been taken to include inexpensive recipes.

THE NEWS—continued.

Will Gas-Driven Motor-Omnibuses Soon be Seen in England?

According to the "Journal des Usines à Gaz," 1931, 55, 557 (Nov. 20), the demonstrations in Belgium and France of gas driven motor vehicles have created great interest in England. At the request of a number of gas engineers in this country, M. Pignot visited London on Sept. 21 to furnish all the necessary information to an important meeting held in the offices of the National Gas Council. Those present included Drs. Walther and Jaubert and Messrs. Stephen Lacey, Morton, Bell, Dieterichs, Masterman, Fottrell, White, and Huskisson. M. Pommeroy, Managing Director of the Daimler Company, was also present.

M. Pignot gave an account, in English, of the experiments carried out by the Paris Gas Company and of the results achieved with different types of vehicles propelled by gas. These included two motor omnibuses, three lorries, three refuse collecting vehicles, and a tractor running on rails. As a result of the ensuing discussion, M. Pommeroy gave an assurance that if two British gas undertakings, for instance those of London and Birmingham, would install compressing plant, his firm would doubtless be willing to equip two motor omnibuses which would ply between these two towns.

Institution of Gas Engineers.

Members of the Institution are invited to attend the meeting of the Institution of Chemical Engineers on Friday, Dec. 11, in the Rooms of the Chemical Society, Burlington House, Piccadilly, W. 1, when a paper on "The Manufacture of Asphalt from Cracking Process Residues" will be read by Mr. F. M. H. Taylor, B.Sc., A.R.C.S., A.I.C. The chair will be taken by the President, Mr. W. A. S. Calder, F.I.C., at 6 p.m.

Round the World and Round Again.

It does not fall to the lot of many in the Industry twice to tour the world in pursuance of its interests, and it is therefore all the more interesting to read Mr. F. J. West's account of his three journeys—two round the world and one to South Africa—re-printed from "West's Gas" in the form of a most interesting booklet, profusely illustrated by photographs taken in four continents.

The descriptions of these journeys, states Mr. West, have been published in response to the request of friends who have maintained that they will be of interest to some whose business may take them similarly abroad and who may find in them useful hints on the conditions prevailing in other parts of the world, to some who have undertaken similar journeys and who will enjoy comparing these with their own impressions, and to many whose business keeps them at home but to whom travellers' tales are a source of delight.

Actuated by a variety of motives, the original journey to Australia was inspired by a desire to meet personally business friends with whom the author's firm had had dealings for many years, and to renew acquaintance with men who had left the Old Country to build up the resources of the Empire in those distant lands.

Mr. West speaks enthusiastically of the cordial reception and generous hospitality he received on his world tours, in the course of both of which he travelled over 55,000 miles. "We have seen many interesting sights," he says, "and enjoyed beautiful and wonderful scenery, but the outstanding and ever-to-be-remembered feature of our trip has been the wonderful reception and hospitality we have enjoyed in all parts. It has been at once flattering and genuine in its intensity."

In South Africa.

The official opening and inauguration of the new gasworks in Johannesburg, referred to in the "Journal" in April, 1921, was responsible for the journey to South Africa, and Mr. West's reminiscences of this trip make very interesting reading. He describes the Kruger National Park, which is a huge wild game reserve some 9300 square miles in area, and tells how the general belief that wild animals in their natural state can only be seen by the big-game hunter mounted on elephants or horses, and with numerous guides and natives, was completely dissipated.

From time to time we have published in these pages accounts of certain portions of Mr. West's tours, but the whole connected narrative, with its accompanying illustrations, makes most interesting and entertaining reading.

Report of the Colonial Gas Association.

The Colonial Gas Association report states that after providing £10,579 for depreciation, the amount at credit of revenue account is £111,085, to which must be added the balance brought forward from last year—viz., £19,124. Deducting bank, loan, and debenture interest, and the sum required in April last for interim dividends then paid of 4 p.ct. and 3½ p.ct. on preference and ordinary shares respectively, the amount remaining to the credit of the net revenue account was at June 30 last £66,825. The Directors recommend as follows: (*a*) That a dividend at the rate of 8 p.ct. per annum (less interim dividend of 4 p.ct. for the half-year ended Dec. 31, 1930) be paid on the preference shares; and (*b*) that a dividend of 6½ p.ct. per annum (less interim dividend of 3¼ p.ct. for the half-year ended Dec. 31, 1930) be paid on the ordinary shares; and (*c*) that £13,800 be set aside for Australian income taxes on profits earned to June 30, 1931; and (*d*) that the balance (approximately £22,459) be carried forward to the next account. Owing chiefly to the depressed conditions prevailing throughout Australia during the year, the sales of gas show a decrease of 10·9 p.ct. upon the sales for the preceding year. The decrease in sales of gas by subsidiary gas undertakings was 7·3 p.ct.

Cathedral Memorial Service to Gas Workers.

Many hundreds of ex-servicemen marched in procession from Blackfriars Bridge to Southwark Cathedral on Saturday, Dec. 5, to a memorial service to South London's gas employees who fell in the war. The men, who are members of the Old Comrades' Association, were headed by the Metrogas Military Band.

Directors of the South Metropolitan Gas Company and relations of the fallen attended the service, which was conducted by Canon J. B. Haldane. Canon H. G. Monroe addressed the gathering.

During the war 3744 South Metropolitan Gas Company employees joined the colours and more than 1000 casualties are recorded on their Roll of Honour. Notices announcing that any co-partner of the Company enlisting for active service would be reinstated on his discharge from service may still be seen at the South Metropolitan Gas Company's offices in South London.

Lighting of the Thames Tunnel.

The following historical note is taken from the current issue of the "Co-Partnership Herald" of the Commercial Gas Company.

An Act of Parliament of a novel character and of some interest in connection with the lighting of the Thames Tunnel by gas was passed in July, 1854. It was obtained by the Ratcliff Gas Company to relieve it from certain penalties it had incurred by supplying gas outside the district prescribed in its Act of Incorporation, 1823. For this it was "under penalties of 5s. for every cubic foot of gas so supplied, and 20s. for every lamp so lighted for every hour in which the same shall be so lighted."

When the Thames Tunnel was completed in 1843, one-half of it was lighted by the Ratcliff Company and the other half by the Phœnix Company whose works were on the other side of the river. This continued until 1853, when, in consequence of a division of the districts between the South London companies, the lighting previously carried out by the Phœnix Company was handed over to the Surrey Consumers Company, much to the dissatisfaction of the Tunnel Company. Thereupon the Ratcliff Company supplied the tunnel lamps with gas and also the inhabitants of Tunnel Square on the south side of the Thames.

At the instance of a common informer, a gentleman described as a distiller of Snow Hill, Holborn, legal action was taken to recover penalties incurred. Although they actually amounted to about £600,000, the initial amount claimed was £10,000, reduced to £1000 while the Court proceedings were in progress. The case was heard before Mr. Justice Coleridge in April, 1854, and the Attorney-General, in addressing the jury on behalf of the Company, commented upon the fact that the plaintiff, being a common informer, had no interest in the matter.

The jury returned a verdict for the plaintiff with 40s. damages, adding somewhat illogically that they did not see that anyone had been damaged; that the Thames Tunnel was not built at the time of the Act, and that it had to be lighted.

The Judge said that the fact that the tunnel had to be lighted had nothing to do with the jury. It was for them

to give a verdict, and if they would not give more than 40s. he could not help it.

A second action was brought by the plaintiff against the defendants in June, 1854, and under these circumstances the Ratcliff Gas Company came to Parliament late in the session for relief. Despite the opposition of the Surrey Consumers Company, the standing orders of the Houses of Parliament were suspended, and a Bill was passed relieving them from all the penalties to which the original Act had rendered them liable.

Gas Company's Motor Transport.

An interesting addition to the Gas Light and Coke Company's extensive fleet of Dennis vehicles formed part of Messrs. Scammell & Nephew's exhibit at Olympia last month.

The purchasers of this machine have previously been interested principally in open lorries and vehicles with pneumatic road-breaking equipment, but they have recently commissioned the van shown in the accompanying photograph. The chassis is a Dennis forward-control 2-tonner.

Although of the large-capacity " Luton " type—*i.e.*, with an enclosed carrying-space over the driver's cab—the cab is quite separate from the body, the intervening space being covered by a neat cowling attached to the cab. By this means, the superstructure is freed from practically all strains caused through chassis flexure, and the cab, with its opening windscreen and glass side panels, may reasonably be expected to remain rigid and free from creaks and squeaks.

In addition to the roller-shutter door at the nearside, the same feature is found at the rear, where it closes down on to a hinged tail-board.

A Progressive Public Utility.

Admiration of the great growth of the Brighton, Hove, and Worthing Gas Company was expressed at the annual dinner and dance held at the Royal Pavilion, Brighton, on Friday, by a number of local municipal government officers who were present. The Town Clerk of Brighton (Mr. J. H. Rothwell, C.B.E.), said the Gas Company had advantages over municipal public utility bodies, for it had admirable co-partnership and contributory pension schemes. The Town Clerk added that in Brighton, which covered a large district, there was ample room both for the Company's gas and municipal electricity.

A Company Director, Mr. E. L. Burton, for 26 years Secretary to the Company, responding, recalled that when he first entered the service of the Company the capital was less than £500,000; now it was £1,500,000. The revenue from gas was then £111,000, a contrast with £608,000 at the present time.

Both Mr. Percy E. Browne, the Company's Distributing Engineer, and Mr. Daniel Edwards, Brighton Borough Engineer and Surveyor, spoke of the good feeling which exists between the Brighton Corporation and the Company—a happy sign for both.

Mr. C. H. Rutter, M.Inst.C.E. (Engineer and General Manager), presided, musical honours being accorded him. Others present were Mr. Hyde C. Burton, F.C.A. (Secretary), Mr. H. V. Corfield (Engineer, Portslade Works), Mr. C. F. Botley, M.Inst.C.E. (Engineer and General Manager, Hastings Gas Company), and Mr. R. A. Dendy (Solicitor to the Company).

THE NEWS—continued.

International Union of the Gas Industry.

At a meeting of the Executive Committee held in Paris on Oct. 17, it was decided to investigate the following problems, the preparation of the individual reports being entrusted to the countries indicated.

(1) Methods for the development of the use of gas.
  (*a*) For domestic purposes (Great Britain).
  (*b*) For industrial purposes (including the hotel industry) (Belgium).
  (*c*) Tariff systems (Czechoslovakia).
(2) Co-ordination of testing methods for gas appliances and standardization of stamping procedure (France).
(3) Co-ordination of and guarantees in connection with methods for testing plant for the manufacture of gas (Germany).
(4) Recommendations relative to safety in gas installations (Switzerland).

The reports will be presented at the forthcoming congress of the Union at Zurich in September, 1934.

Danish Gas Company.

The accounts of the Company for the year ended June 30, 1931, show that the balance standing to the profit and loss account, after charging pensions, administration expenses, &c., and transferring Kr. 199,805 to the redemption accounts is Kr. 488,564·57. Out of this sum the Directors recommend that a dividend of 6 p.ct. or Kr. 8·10 per share be declared. This will leave Kr. 233,414·57 to be carried forward, a decrease of Kr. 67,793·03 on the amount brought in.

There has been an addition to capital expenditure of Kr. 556,763·98, which amount includes the Kr. 440,000 for the new gasholder at Odense; the remainder is for additional mains, services, meters, &c. The quantity of gas sold during the past year has been 355,291,000 English c.ft., against 373,853,000 c.ft. in the previous year, being a decrease of 18,562,000 c.ft. or 4·96 p.ct. This is due to completing the new system of reading meters under the improved method of collecting gas rentals mentioned in the last report.

The accounts for the year are drawn up in a somewhat altered form. As changed they conform with the requirements of the new Danish Companies Act which came into force Jan. 1, 1931. Under the new Act it has been necessary to prepare amended Articles of Association, and the main point in the proposed new Articles is that it provides for a Board of from 5 to 7 members with a majority resident in Denmark, instead of, as at present, a Committee of shareholders and a Board in Denmark, as the new law would not permit of a committee of shareholders, resident in England, having similar duties to those provided in the present articles. According to the law a majority of the Board must reside in Denmark, and either be of Danish nationality or have resided for at least five years in that country; it is therefore proposed to increase the present Board by four members, so that the committee of shareholders may act as Directors. This will necessitate the election to the Board of two new Danish members.

In drafting the new Articles the interests of the British shareholders have been fully borne in mind.

Board of Trade Inquiry at Sedgley.

An application by the Sedgley Urban District Council for a Special Order under the Gas Undertakings Acts, 1920 and 1929, to permit of the extension of the Council's gas-works at Lower Gornal was the subject of an inquiry at Sedgley on Nov. 30 by Mr. H. W. Spencer, an Inspector of the Board of Trade. The scheme is to cost, roughly, £19,000.

Mr. T. R. Knight, Clerk to the Council, said the works had not been materially extended since they were taken over by the Council and the prospective requirements of the district, particularly the development of the Goldthorne Hill Estate, necessitated extensions. At present they were working up to the maximum of their plant. The possibility of removing the gas-works to a site on the Great Western Railway line had been inquired into and the idea abandoned, and the scheme now put forward was the only alternative.

Mr. Joseph Brettle, Gas Engineer and Manager, said it was desired to enlarge the plant, to replace certain parts of it, and to add to it. The additions would include a new gasholder, because at the present time, although a storage capacity of a day's output was regarded as a minimum

THE NEWS—*continued.*

under modern conditions, they had only a storage capacity of 47 p.ct. of a day's output.

Cross-examined by Mr. A. B. Whitehouse, representing a large number of occupiers and owners of houses near the gas-works, who complained of the noxious fumes and smuts emitted from the works, Mr. Brettle said the developments proposed would be likely to reduce the grounds of complaint. The possibility of removing the gas-works to the Goldthorne Hill Estate had not been explored.

Evidence was given by nearly twenty objectors, all of whom spoke of the nuisance they suffered from the gas-works.

Mr. Whitehouse said the site of the gas-works was in a congested area and was thoroughly unsatisfactory.

The inquiry was closed.

A Present to Burnley Gas Consumers.

Burnley's Gas Engineer, Mr. J. H. Clegg, invited members of the Council, among whom were several new members, to visit the Corporation Gas-Works last week. At the subsequent gathering Mr. Clegg pointed out that gas into holder was produced at the new works at 11d. per 1000 c.ft., a reduction of 1s. 1d. compared with the old works. The cost of putting down another complete unit would have been £125,000, and as the cost of purchasing coke oven gas from Altham Colliery meant a capital expenditure of about £60,000 the Committee had decided to go in for the latter. The work had now been completed for £50,700. Mr. Clegg explained that the main from Altham for the first mile was of cast-iron piping and afterwards of steel above ground, this being the first main laid over ground for such a distance. Though that gas was in no way a substitute for that made in the gas-works, it had saved in capital expenditure £75,000, and the interest on that amount was being saved.

The Oswald Street Works were well equipped with chemical plant, including tar distillation plant. The financial results on tar were good, and they succeeded up to last year in making the liquor ammonia branch a success. They were able to make sufficient coke for the Burnley market. By putting up those new works they were making an annual present to gas consumers of £45,000, and the Str Lighting Committee benefited by £5000 a year through the low charges for gas.

Glover-West Verticals at Cape Town.

In 1913 the first Glover-West vertical retort plant was installed at the Woodstock Works of the Cape Town and District Gas Light and Coke Company, Ltd., to cope with the rapidly increasing demand for gas. It included 16 retorts with a daily capacity of 500,000 c.ft. of gas at a calorific value of 500 B.Th.U., with a steel-framed retort house of the type that has since become standard, together with coal and coke handling plant. This installation sufficed for the whole of the Company's needs until 1921, when a further extension became necessary. A second contract was entered into with Messrs. West's Gas Improvement Company, Ltd., for an installation comprising a retort bench with 24 vertical retorts designed to produce 750,000 c.ft. of gas per 24 hours, in a complete new retort-house, with an extension of the gravity-bucket conveyor from the first installation.

These retorts had, of course, been of the old model, and when it became necessary in 1930 to increase the carbonizing capacity of the works it was found possible to do this on the same ground area by the reconstruction of the No. 2 retort bench by the substitution of the new model retort, by which means the gas-producing capacity of this section of the plant has been increased by 50 p.ct., equivalent to an additional daily capacity of 375,000 c.ft. The advantages of this policy have been well realized in this instance. At the same time, an additional line of gravity-bucket conveyor of the new lipped type has been installed, completely encircling the No. 2 bench, and designed to elevate and discharge coke into two new storage hoppers, with a 50-ton compartment for feeding railway wagons, and a 30-ton compartment for the supply of road vehicles and bags. And the storage capacity of the coal bunkers above the retort bench has been increased 100 p.ct.

The reconstructed installation has been equipped with waste-heat recovery plant in the form of a Spencer-Bonecourt induced-draught, fire-tube boiler, which is capable of an equivalent evaporation of 5500 lbs. of water per hour from and at 212° Fahr., steam being generated at a pressure of 120 lbs. per sq.in. and superheated 50° Fahr.

The work of reconstruction had to be carried on with the minimum of interference with the production of gas. It was, therefore, necessary to dismantle and rebuild one setting first, while retaining the other two settings of the same bench in commission.

The coals used are exclusively South African in origin. They consist of a mixture of slacks and smalls. The average approximate analysis of the mixture is moisture 2·3 p.ct., volatile matter 21·5 p.ct., ash 9·75 p.ct., and fixed carbon 66·45 p.ct. The coking characteristic is medium.

"R. & M," in "West's Gas."

Hartlepool Company's Progress.

The Hartlepool Gas and Water Company was dealt with in a recent "Potential Investments" column of the "Financial Times," and reference was made to its continued expansion despite trade depression.

The Company was incorporated, it was stated, by Special Act in 1855, and its statutory area of supply covers 30 square miles, with a population of between 90,000 and 100,000, comprising the Hartlepools, Seaton Carew, Greatham, &c.

The statutory maximum price of gas is fixed at 13·8d. per therm, and since 1926 it has remained at 8½d. Dividends are not subject to a sliding scale, and the maximum of 5 p.ct. has been paid for the last nine years.

Last year a Bill was promoted to enable the Company, *inter alia*, to construct a new reservoir. The Royal Assent was given on Aug. 1, and in view of the offer of financial assistance from the Unemployment Grants Committee of His Majesty's Treasury the work was commenced, while, with similar help, a new 750,000 c.ft. gasholder has been constructed, and further economies are expected.

On account of the current year the usual interim dividend of 2½ p.ct. was paid on Aug. 31.

Last year's balance-sheet reflects the new issue of £58,735 of debenture stock, of which £33,990 was required to redeem an earlier issue falling due and the balance to meet the general progressive expansion of the Company's works.

The authorized stock capital is £949,000. Borrowing power is one-half the paid-up capital, including premiums—namely, £371,227—of which there is exercised and outstanding £223,117 in 5 p.ct. debenture stock redeemable at par at varying dates. This stock is quoted at 95 and gives a return of 5¼ p.ct. At the credit of capital account there is also £58,337, being premiums on gas capital shares sold by auction prior to consolidation under the Act of 1900.

An Economy Exhibition.

The opening of the unique Easiwork Showrooms at 242, Tottenham Court Road, London, W., by Sir William Arbuthnot Lane on Friday, Dec. 4, reveals what is virtually an exhibition of better housekeeping and economy equipment.

The novel decorative and lighting scheme of the shop-front, window enclosures and interior, strikes an entirely new note in store design and is at once original and even daring in conception. The imposing entrance hall is carried out in a most attractive modern scheme composed of various shades of grey, with artistic mosaic floor, while all the fittings are of brightly polished stainless steel.

On the first floor is a spacious Lecture Hall and School of Cookery, where lectures and demonstrations relating to the most modern and approved methods of cookery will be held regularly. A distinctly novel feature is the loud speaker installed in the cooking range through which students and visitors will hear the various B.B.C. talks on food, cookery, and other subjects of domestic interest.

It was of interest to note that gas alone is utilized for cooking in this section, the apparatus being the firm's new "Gurney" range. This range is finished throughout in porcelain enamel. All hinges and bolts are concealed, and every corner is rounded for beauty and convenience, there being a porcelain enamelled control panel with self-locking taps. An automatic lighter actuated by the pressing of a button is standard equipment, and the burners are of the star type, an automatic oven heat control being optional.

The Millionaire's Kitchen.

Included in a remarkable series of five model kitchens of to-day, the cost of equipping which ranged from £10 to £500, visitors find what is described as "The Millionaire's Kitchen"—a palatial culinary domain with the most up-to-date labour-saving equipment. This includes a patent dishwasher sink that washes up in record time; a large refrigerating cabinet; and a large gas cooking range. All the metal fittings are of brilliantly polished stainless steel, while the interiors of all the cupboards round the

walls light up automatically as the doors are opened. Another of this series represents what is probably the smallest kitchen in the world, yet it is fully practical in every sense and completely equipped with its gas cooker and all the latest labour-saving devices.

Here also is to be found what at first sight might appear to be an impossibility—a fully equipped one room flat, providing a bedroom, bathroom, dressing room, and living room. The walls, ceiling, and floor are all of rubber in an attractive decorative scheme of blue and brown. In the narrow kitchen, hidden by sliding doors when not in use, is a refrigerating cabinet and complete cooking arrangements, and the flat is centrally heated by gas.

Other Novel Ideas.

Other features of these remarkable Easiwork showrooms include a model laundry where demonstrations will be given regularly; all manner of labour-saving and economy equipment, embracing cookers that cook a complete meal of joint, potatoes, mixed vegetables, and stewed fruit all in one in half an hour; complete home canning equipments; kitchen cabinets of all kinds; gas ranges enamelled in various colours to harmonize with any scheme of decoration and a series of attractive gas fires of various designs, including the "Panella"—one of the latest types of fire, specially designed for use with modern architecture and modern interior decoration. It is fixed flush with its "surround" a foot or more from the floor level. The hearth is abolished. The "Panella" can be obtained in an armoured, copper, brass, pewter, or stainless steel finish. Other fires include the "Classic" range and the "Red Sphinx."

THE NEWS—continued.

Lisburn Seek to Amend their Gas Act.

At an inquiry before Mr. J. C. Davison, K.C., M.P., in Lisburn, into the application of the local Urban Council to have a section in their Gas Act of 1909 amended so as to permit the Department to sell fittings and let for hire, fix, repair, and remove them, vigorous opposition was forthcoming from the Master Plumbers' Association of Ulster.

Council for applicants said that recently six gas orders had been made to English urban authorities on the lines which the Urban Council sought. In Northern Ireland there were six undertakings which did not have these restrictions upon them—namely, Newry, Newtownards, Bangor, Strabane, Ballymena, and Omagh. The gas undertaking in Lisburn had been, since 1928, in competition with the Lisburn Electric Supply Co., and the Gas Manager in Lisburn recognizing the fact that for the purpose of meeting that competition gas must be made as attractive as possible, started to supply fittings to customers, overlooking the fact that there was a limitation on the powers of the Urban Council. Objection was taken. It was the Council's contention that the fittings were best done by those specially trained to do them.

Mr. A. S. Brook, the Gas Manager, said that it was a menace to the Undertaking to have poor and inefficient fittings. These did not give the consumer a proper supply.

Counsel for the opposition suggested that the Gas Manager's energy should not be devoted to a new line of business which could not be commercially sound and was unjust.

Evidence followed from the Plumbers' Association and trading organizations.

"M.L.S." Superheaters.

The Superheater Company, Ltd., is an independent organization specializing in design and construction of superheaters for industrial, marine, and locomotive service, and development of plant for efficient production and utilization of steam at all pressures and temperatures. We were therefore interested in receiving from the Company a copy of their recently published brochure descriptive of the design, construction, and application of "M.L.S." superheaters to all classes of steam power and process plants with examples of installations in water tube boilers of large capacity operating at high pressures and temperatures.

At the outset the brochure explains the advantages of superheated steam, with charts to indicate the additional B.Th.U. per lb. of steam and the volumes of saturated and superheated steam at various pressures and degrees of superheat. The use of superheated steam in reciprocating engines and in turbines is then dealt with fully, with diagrams to show the percentage of initial cylinder condensation which may be expected at various points of cut-off with initial dry-saturated steam, and the superheat required to prevent this; and the approximate reduction in the steam consumption of a turbine which is realized by the use of superheat.

The remainder of the publication is devoted to illustrations of actual installations and the application of the "M.L.S." superheater to water tube boilers of all descriptions. The "M.L.S." protected radiant superheater is described, together with superheater suitable for waste-heat boilers and "Lancashire" boilers, while the advantages of independently-fired superheaters for high temperatures are set out.

Diagrams are given showing results obtained with "M.L.S." single-pass "Interdeck" superheaters at two large power stations, and "M.L.S." water-cooled furnace walls are described. Finally a list of representative users of the firm's installations is given.

A New Portable Heater.

A gas heater which, by reason of its very small consumption, fulfils the recognized requirements of hygiene satisfactorily, while offering the added boon of easy portability, has been offered to the Industry by Messrs. John Wright & Co., Birmingham (Radiation Limited Proprietors).

The greatest care has been taken in the design of this new "Tourist" portable heater, which is intended for use as an additional source of warmth, that can be carried from bedroom to dressing room, bath room, &c., as required, and just plugged into the gas connection. The heater makes use of luminous flames, and the design of the burner provides for complete combustion. The heater is light and easily carried about, while its output of warmed air is at the rate of 5000 to 6000 c.ft.

The luminous burners are controlled by a governor and need no adjustment, and the gas consumption at the full-

on rate, is the remarkably low figure of 8 c.ft. per hour. Particularly attractive is the appearance given to the heater by its curved copper reflector, which is so shaped that when the burner is alight, the glow is caught and reflected through two specially-designed red glass panels. The gas is ignited through the lower of these panels.

The "Tourist" heater would appear to be a very desirable addition, which should appeal to a large public.

THE NEWS—*continued.*

Plymouth Gas Sales.

Commenting upon the Plymouth and Stonehouse Gas Light and Coke Company in a recent "Potential Investments" column, the "Financial Times" stated that the Company was incorporated by the Special Act of 1855 and acquired the undertaking of the Plympton Gas Company in 1921. The statutory area of supply covers about 53 square miles, comprising the places mentioned and their adjacent districts, the number of consumers now being about 45,000.

For the last ten years sales of gas have recorded a regular yearly increase from 1,362,175,000 c.ft. to 1,845,563,000 c.ft., in spite latterly of generally unfavourable conditions. The progressive increase in the Company's business has necessitated the provision of a new gasholder and large extensions of its mains. Powers to raise the necessary capital for these purposes have been obtained, and advantage was taken to incorporate in the Special Order of the Board of Trade powers for the extension of the area of supply.

Notes from Scotland.

The Price of Gas at Lockerbie has been reduced from 5s. 5d. to 5s. per 1000 c.ft.

The Rothesay Gas Department has opened new showrooms at 72, Victoria Street, Rothesay.

Lighting of Textile Factories.

Convenience of Gas.

At a gathering of textile mill managers at Preston on Dec. 4, Mr. C. Carrington Barber, Industrial Representative of the Preston Gas Company, speaking on "Industrial Incandescent Gas Lighting," remarked that in the matter of convenience, gas was very little, if at all, inferior to its competitor—electricity. Appliances were available whereby one or more gas burners could be readily turned on from a distance by means of a switch, which afforded the advantage that the gas could be turned up or down to the extent desired. In the case of electric lighting such an operation would require installation of a rather elaborate device. Gas with its modern scientific lamps and auxiliary apparatus had no equal as an artificial illuminant in textile establishments of all descriptions. Incidentally, incandescent gas lighting could not be approached for colour matching work, a point which would be more than fully appreciated by those whose products embodied yarns of the fashionable new shades which appeared to be increasing from day to day in both numbers and names. Industrial lighting was being given very close attention by the Gas Industry and illumination engineers generally, and the fact that thousands of textile mills in Lancashire, Cheshire, Yorkshire, Scotland, and Ireland, and other parts of Great Britain, had from the start used gas lighting, continued to use gas lighting, and had no intention of making a change, proved that the mills concerned were fully satisfied with gas and with the service which gas undertakings provided for their consumers.

Gas Ventilates.

During a recent inspection of the lighting of factories by a Government Board of Experts, they visited a large weaving shed in Belfast, containing some 500 looms and lighted throughout by gas, and they expressed the opinion that it was so far the most scientifically lighted shed they had inspected. Among the advantages of gas lighting over electricity were: An electric lamp gave its full lighting efficiency the first few hours of its use. The rapid accumulation of dirt and fluff on electric lamps in textile mills soon impaired the full degree of illumination, whereas with incandescent gas lighting the dirt and fluff were burned up on coming into contact with the mantle, so that the mantle gave full illumination during the whole of its life. Gas lighting gave ventilation by continually moving the air in the room. When the room temperature was below about 60° Fahr. it had an appreciable warming effect, specially noticeable during cold days, thus improving working conditions without extra cost.

In answer to various questions the speaker contended that all convenience applicable to electricity applied also to modern gas lighting. Scientific experiments showed that the atmosphere was purer after burning gas than when electricity was used.

The "Fescolizing" Process.

An interesting inspection of the works of Messrs. Fescol, Ltd., 101, Grosvenor Road, S.W. 1, was made by the London and Southern District Junior Gas Association on Wednesday, Dec. 2. The visitors were welcomed by Mr. Nicholson-Smith, the Managing Director, who, before conducting them over the works, gave an outline of the "Fescolizing" process and exhibited examples of the many and varied applications of the process.

The name is descriptive of a patented process known as "Fescolizing," which is utilized for the electro-chemical deposition of metals on metals. Its applications and uses are quite distinct from those of plating. The principal difference between the two methods lies in the interlocking between the base and the applied metals obtained by the "Fescol" process, which is claimed to give perfect adhesion and cohesion.

Many tests extending over a number of years have proved the adhesion obtained by means of the process. Reports from the National Physical Laboratory show that it is not possible to remove the applied material, attempts to do so resulting in fracture of the original material. Plating is therefore not in any sense a substitute for "Fescolizing." The significance of the "Fescol" process is that it enables very heavy deposits to be put on, and permits the deposited part to be subjected to torsion, shear, and friction, without disturbance. Further, the process being a cold one does not distort the part under treatment.

Applications of the "Fescol" Process.

The applications of the process are extremely wide, and may for convenience be divided under three headings, which can be combined on occasion. Taking these in order of importance on the principle that prevention is better than cure:

Initial protection against corrosion and erosion is obtained by providing new parts with a non-corrosive surface which will withstand the attack of specific solutions, moisture, and atmosphere.

Next in importance comes the restoration or building-up of parts which have been subject to mechanical wear or chemical action, or a combination of these. Such parts can be made up to their original dimensions, and are further protected against future deterioration by means of the material selected for their restoration.

The third application of the process is decorative, for which purpose polished chromium or scratch-brushed-nickel are generally advised. The metals most commonly employed are: Nickel—suitable for most initial protection against corrosion and for restorative work. This material also stands up well to torsion and abrasion. Chromium is used as a bearing material, for which purpose its extreme hardness makes it specially suitable for withstanding high unit pressures. It is also employed in conjunction with nickel for decorative purposes. Cadmium is particularly recommended for its properties as a corrosion resistant and is applied as a protection against the action of sea water, atmosphere, &c. Lead gives protection against the action of sulphuric acid. Copper is called for in certain cases, but is rapidly being replaced by one or other of the above materials.

From a selection of the above materials, protection can be given against most of the chemical or abrasive actions to which parts may be exposed.

Mr. Nicholson-Smith pointed out that their work was not guaranteed, but if it was not successful, they had it back again and endeavoured to put the matter right. He showed the members numerous samples submitted to the National Physical Laboratory for test, which gave definite proof of the adhesion obtained by the "Fescol" process, it being stated in every case that the deposited metal could only be removed by breaking down the basis metal.

Numerous other illustrations of work done throughout the country were also shown, including examples of work utilized in gas-making plant. Work was seen actually in progress in the various vats, the largest of which for nickel deposition are 15 ft. 6 in. deep by 12 ft. by 10 ft.; also the process utilized for the deposition of various grades of chromium, including bright decorative work and hard engineering chromium. The method of machining nickel and chromium was also explained.

After the inspection of the works the visitors were entertained at tea, and a vote of thanks to Messrs. Fescol, Ltd., was passed on the proposition of Mr. H. C. Sims (Junior Vice-President), seconded by Mr. J. M. Webber (Croydon), which was acknowledged by Mr. Nicholson-Smith.

THE "JOURNAL" TECHNICAL RECORD

Which contains Reports of Meetings of Gas and Allied Associations

North of England Gas Managers' Association

(Auxiliary Section)

The 23rd Half-Yearly Meeting of the Auxiliary Section of the North of England Gas Managers' Association was held in the Gas Office, Newcastle, on Saturday, Dec. 5, when Mr. Gilbert B. Howarth, Chief Chemist, Newcastle-upon-Tyne and Gateshead Gas Company, read a paper on "Thermal Efficiency in the Gas Industry."

The chair was taken by Mr. J. E. DIXON, Works Manager, Elswick Works of the Newcastle and Gateshead Gas Company.

NEW OFFICERS.

The following officers were elected for the ensuing year:
Chairman—Mr. C. S. Read, Washington Chemical Company, Washington, County Durham.
Vice-Chairman—Mr. J. B. Henderson, Wallsend.
Committee—Mr. G. J. Duncan, North Shields, and Mr. G. Neil, West Hartlepool.

The SECRETARY (Mr. A. H. Bagshaw) announced that Mr. L. H. Sensicle, of London, a member of the Committee, who was now on business in America, tendered his resignation, as his business prevented him from attending to the activities of the Committee.

THERMAL EFFICIENCY IN THE GAS INDUSTRY.

By GILBERT B. HOWARTH, M.Sc., A.I.C., Chief Chemist, Newcastle-upon-Tyne and Gateshead Gas Company.

I have decided to dedicate this paper mainly to the younger members of the Section. If at the end the more experienced members say, "You have told us nothing fresh—we knew all that years ago!" I shall take that as evidence that my tale has been well and truly told. My object is to show at the same time the importance and the simplicity of a subject that has often been found somewhat scaring in the past.

It is necessary at the outset to have a clear conception of what we mean by the term "thermal efficiency." When an engineer speaks of "efficiency," he has in mind a percentage figure that usually expresses the ratio of the energy usefully employed to the total amount of energy supplied. For example, in the case of a steam engine the rate at which energy is supplied to the piston by the steam is given by the Indicated Horse Power (obtained from an indicator diagram), while the rate of useful energy production is given by the Brake Horse Power (measured by some form of brake or dynamometer). The Mechanical Efficiency is then the ratio of these two quantities expressed as a percentage.

WATER HEATERS.

Exactly the same reasoning may be used in the calculation of Thermal Efficiency, except that heat units are used instead of units of mechanical energy. Thus, to take a simple case, a geyser that burns 100 c.ft. per hour of gas of calorific value 500 B.Th.U. per c.ft. receives an hourly heat input of 50,000 B.Th.U. If one gallon of water per minute is heated from 50° Fahr. to 120° Fahr., the hourly heat output is 42,000 B.Th.U. and the thermal efficiency is thus 84 p.ct., and here our scientific curiosity is aroused—where has the remaining 16 p.ct. gone?

The distribution of the unused heat deserves the closest investigation. A quantitative knowledge of the various channels of heat dissipation shows at once the direction in which there is greatest scope for economy, for every single reduction in one of these items leads directly to a corresponding increase in the thermal efficiency.

In the case under consideration the loss of heat by radiation and by transmission to the air circulating over the body of the geyser is actually found to be very small, so that the almost complete elimination of this amount by the addition of insulating materials would produce only a very trifling improvement in the thermal efficiency.

Practically the whole of the missing heat is carried away by the products of combustion of the gas. Owing to the limited heating surface available, it is impossible to extract the whole of the heat from the hot gases. This is achieved in the case of the Boys calorimeter, notably by the use of the counter-current flow with a large heating surface, but the greater output demanded from a commercial appliance results in the products of combustion leaving the flue outlet at a temperature well above that of the heated water.

The admission of an unnecessarily large excess of air will obviously lead to increased flue loss, since the whole of this air must be heated up to the flue temperature. On the other hand, an inadequate excess of air leads to incomplete combustion, the appearance of combustibles in the flue gases representing heat that cannot be utilized.

The storage water-heater presents different conditions. The small gas rate with a relatively large heating surface is accompanied by small flue loss, with the qualification that the provision made for rapid heating-up involves a risk of excess air supply when the gas is turned down by the thermostat. On the other hand, the radiation and convection loss remains the same whether the water is heated quickly or slowly, so that this item attains considerable importance in appliances of this kind. Hence every well-designed storage water-heater is provided with an insulating jacket of some kind.

CARBONIZING PLANT.

There are many carbonizing experts here to-day. Possibly they feel that domestic water-heaters make little appeal to the man engaged on the manufacturing side of the Gas Industry. It is, however, characteristic of scientific methods to aim at fundamental principles that can be applied in a wide variety of different cases. Thus, the knowledge gained from the examination of the simplest water-heaters may be used (with suitable modifications) for judging the performance of an unlimited variety of industrial furnaces and for exploring the more complex details of the retort house.

Of the total thermal value of the coke fed to the retort house producers, how much is usefully employed by being transmitted to the interior of the retorts? The heat taken up by coal during carbonization is not known in the way that we know the specific heat of water. The position must be approached from a different angle. The various kinds of heat loss associated with the supply of a given quantity of heat must be separately evaluated, and the portion unaccounted for must then be regarded as having passed into the retorts.

The flue loss may be calculated from the temperatures and composition of the waste gases. The calculation involves a knowledge of the specific heats of the various gases over the temperature range involved. There is often some doubt as to the figures that should be used for this item. The formulæ selected by the Research Staff of the Institution of Gas Engineers and the University of Leeds* are arranged in a convenient form for application to gas-works problems. An alternative method† incorporates these data in a graph giving directly the heat content of the flue gases arising during the combustion of unit weight of carbon.

The water vapour accompanying the flue gases must not

* Twelfth Report of Gas Investigation Committee, 1924.
† Howarth, J.S.C.I., 1920, **39**, 329-333 T.

be overlooked. The amount may be calculated with sufficient accuracy from the dew-point of the flue gases, or from the hydrogen content of the fuel together with the water content of the air supply. Allowance must also be made for the presence of combustibles in the flue gases, since the calorific value of these substances is not developed where it can be utilized.

The loss of heat through the walls of the setting may best be calculated from the temperature gradient through the walls. Suitable values for the thermal conductivity of various kinds of brickwork must be used. An alternative computation is based on the rate of transfer of heat from the hot walls to the surrounding air. Laboratory experiments show that the natural laws underlying this convection process are extremely complicated,* and in all but the simplest cases the calculation becomes too complex for general use. Moreover, the precise measurement of the temperature at all points of the wall surface introduces experimental difficulties.

The thermal balance may now be completed by careful weighing and sampling of the coke fed to the producers and of the waste material withdrawn from the ash pans.

This balance will, however, be invalidated if there is any appreciable leakage of coal gas from the retorts into the combustion chambers. The heat developed by the combustion of this gas will allow a reduced coke consumption, giving a fictitious appearance of efficient working. The Institution's Research Staff used a method of detecting such leakage by means of careful analysis of the flue gases,† utilizing the characteristic carbon dioxide content of the dry air-free products of combustion of coal gas as compared with producer gas. This method has also been extensively employed by the Gas Light and Coke Company.‡ The use of this method for the calculation of the exact amount of leakage cannot be recommended, as the characteristic figure of the leaking coal gas may differ from that of the total gas made, while the presence of tar vapours may produce further deviations.

As the products of combustion are required to deliver heat to retorts at a high temperature, it is not surprising to find that they carry away a very large quantity of heat when they leave the neighbourhood of the retorts. This often amounts to more than half the thermal value of the coke supplied to the producers, the heating efficiency being correspondingly low. There is thus ample scope for waste heat recovery.

Waste-Heat Recovery.

In the case of horizontal retorts this is generally effected by recuperators which restore much of the heat to the setting through the medium of preheated secondary air. With vertical retorts the waste gases are made to circulate round the cooler parts of the retorts. In both cases there is ample opportunity for further heat recovery by a waste-heat boiler, possibly followed by a feed-water heater. Each addition leads to the recovery of further quantities of heat, and the thermal efficiency of the installation as a whole is thus brought up to a satisfactory figure.

I have not attempted to describe in detail the exact procedure to be followed in obtaining the thermal efficiency of different types of domestic and industrial heating units. Still less have I wished to quote actual figures which might enable direct comparisons to be made. Rather have I tried to indicate in the most general terms the basic principles that must be remembered in any consideration of the broad question of thermal efficiency. Detailed examples of the application of these principles to individual appliances will be found in the publications of the Institution of Gas Engineers in co-operation with the University of Leeds, in the Technical Papers of the Fuel Research Board, and in a paper before the World Power Conference.§

A scientific man is content to pursue high thermal efficiency for its own sake, but most gas managers demand more tangible evidence of monetary saving before they embark on extensive improvement schemes.

What then is the cash value of an increase in thermal efficiency? This may easily be calculated in terms of fuel saved. In the case of the retort house the hot gases leaving the retorts must necessarily carry a large proportion of the heat available in the coke used in the producers. The recovery of even half of this waste heat may be interpreted as the saving of a considerable tonnage of coke in the course of a year.

On a cooker hotplate a badly designed boiling burner incorrectly adjusted may have a thermal efficiency of 25 p.ct. By attention to design and adjustment it is easily possible to raise the efficiency to 50 p.ct. This represents a reduction of the wasted heat to a third of its former quantity, and the heat saved amounts to twice the heat actually transmitted to the water. From the consumer's point of view, the effect of the increased thermal efficiency is equivalent to a 50 p.ct. reduction in the price of the gas used.

In the case of the geyser the efficiency normally obtained is so high that there is little scope for improvement. It is not desirable to exceed 90 p.ct., as the condensation of water vapour in the cooler parts of the appliance is liable to encourage corrosion. An improvement from 78 p.ct. to 86 p.ct. involves a saving of only about 10 p.ct. of the gas—not a spectacular amount, but a welcome discount on the gas bill.

I have said enough to show that thermal efficiency is not a merely academic plaything devised for the amusement of a white-bearded old gentleman in an alchemist's cell. In every aspect it is closely bound up with the price the consumer has to pay for his gas service, the satisfaction he gets from it, and the attitude he is likely to display towards our competitors. I must leave it to you to see that thermal efficiency is not neglected.

Discussion.

Mr. G. E. Anderson (Willington Quay), discussing the relative thermal efficiency of old-fashioned and modern heating apparatus, and the effects of the methods of operation on the thermal efficiency, said that, while improvements in design generally led to a higher efficiency, those improvements were often accompanied by an increase in cost. It was difficult to know just where to call a halt, and at what precise stage the increase in thermal efficiency was outweighed by the greater cost. He would like to know if Mr. Howarth had any figures regarding the advantages of dry coke cooling plant. If one were asked to design new works, no doubt dry cooling plant would be an attractive proposition, but where the installation was suggested for an existing works, involving the scrapping of an existing plant, then he thought there were doubts as to the advantage, if any, of such a change. He could not agree with Mr. Howarth's figures on the thermal efficiency of the cooker hotplate. A burner might have a thermal efficiency of 25 p.ct., which might possibly be raised to 50 p.ct. Mr. Howarth said that this represented a reduction of the wasted heat to a third of its former value. If the waste before was 75 p.ct., but was lowered to 50 p.ct., then it represented a reduction to two-thirds of the former value.

Mr. C. S. Read (Washington, Chairman-Elect), speaking of the insulation of retort settings, remarked that this was sometimes done in a very haphazard manner, with the result that the insulation did not give its maximum resistance. Many engineers who insulated all sides of the furnace forgot the bottom. He had known a case where heat had penetrated nearly 15 ft. into the earth, while the outside heat of the other parts was normal. That must react on the thermal efficiency. Insulation of gas cookers was another question, and here he thought that the packing was sometimes done too closely. It would solve some of their problems if they could find an insulating material other than slag wool. He believed there was some other material on the market. Science could evolve a higher thermal efficiency by improving the design of burners, but that could easily be lost, in the case of gas cookers, by the type of pan used.

Mr. J. B. Henderson (Wallsend) said that the price of gas to the consumer was reflected in thermal efficiency. He thought that the electric furnace maker spared no pains to consider every item to gain the highest efficiency. The gas furnace manufacturer did not seem to go to the same amount of trouble.

Mr. W. O. Kirkwood (Sunderland) remarked that the actual source of the heat was a subject which deserved the closest investigation. Dr. E. W. Smith, in 1928, had found that the fuel cost per therm in horizontal practice was approximately 75 p.ct. that of labour, and it seemed to him that the actual amount of coke fed into the producer was of more importance than the possible economy which might be gained due to increased thermal efficiency. Mr. Howarth had mentioned that there was a considerable volume of heat carried away in the waste gases. He (the speaker) would like to submit a few figures relating to this. If the temperature of the waste gases was 500° C., the loss of heat was equivalent to 2840 B.Th.U. per lb. of coke consumed. A temperature of 600° C. had an equivalent of 3410 B.Th.U.; 700°, 4000 B.Th.U.; and 800°, 4610 B.Th.U. Hence, for every increase of 100° there was a loss approximately of 600 B.Th.U., which was equivalent to 4·2 p.ct. of the total heat in the coke. Thus, if waste gases were discharged at 800° instead of (say) 550°, there was a loss equivalent to 10 p.ct. of the total heat in the coke. Because of this, he was of the opinion that the temperature of the waste gases should be kept as low as possible. He would ask Mr. Howarth whether he thought that the thermal efficiency of a gas fire increased or decreased with a fall in the calorific value of the gas. Practically domestic burners were affected by speed, and he asked what influence this factor had on thermal efficiency.

Mr. Bath (Newcastle) emphasized that what they needed was more than just thermal efficiency; they wanted a practical and economical efficiency. A number of devices on heating apparatus, such as the thermostat, were going a long way in this direction; but they had to consider the carelessness of the housewife.

Mr. T. C. Whimster (Spennymoor), referring to the increased cost of highly efficient insulating material in retort settings,

* Fishenden, Institution of Gas Engineers, June, 1930.

† Twelfth Report of Gas Investigation Committee, 1924.

‡ Hollings, Gas J., 1928, **182**, 976.

§ Wood and Howarth, "The Principles of Design, Construction, Operation, and Testing of Domestic Gas-Heating Equipment."

said that he was not sure whether this increased cost became worth while, as the life of the insulation was governed largely by the life of the setting, although better insulation might give a longer retort life. Was the additional cost worth while for such a short period?

Mr. F. NICHOLLS (Gateshead) asked what was the alternative method which Mr. Howarth had mentioned for the calculation of flue losses and thermal leakage.

THE AUTHOR'S REPLY.

Mr. HOWARTH, replying to the discussion, said that Mr. Anderson had mentioned the question of the design of plant. To obtain the best results, a well-designed plant needed careful attention and operation. That applied to modern gas fires. An old-fashioned type badly attended and adjusted might quite possibly give a greater efficiency than a modern gas fire badly adjusted. If plant were well designed, then they must insist upon its being carefully operated. Mr. Anderson's reference to thermal efficiency was a question of arithmetic. If a job required 1 therm and the efficiency was 25 p.ct., then it took 4 therms at 25 p.ct. efficiency to do the job. With 50 p.ct. efficiency it would take 2 therms. With 25 p.ct. efficiency, 1 therm was used and 3 wasted. With 50 p.ct. efficiency, only 1 therm was wasted, which represented a reduction of the waste heat to a third of the first value. Mr. Read had mentioned the insulation of retort setting bottoms, and that the heat had penetrated far into the ground. It was not a question of how far or how fast the heat penetrated, but how much. There was no particular reason why there should be insulation on the bottom, he thought. Firm earth beneath the setting was just as effective as if a 10-ft. bank of earth was built around the sides. No further insulation would be necessary, but present insulating methods were more convenient. [Laughter.] Mr. Read had touched upon slag wool for cookers. Aluminium foil was an alternative suitable in some cases. As to pans, when they had improved their burners, they could design a pan which would give the highest efficiency. But then it had to be remembered that the function of a pan was to hold things. If it failed as far as utility was concerned, then no amount of pushing on the basis that it meant increased thermal efficiency, would sell it. Mr. Kirkwood had asked if there was any difference in the thermal efficiency of a gas fire with different calorific values. A fire burning gas at 450 would require to burn more to be equivalent to 500, but the efficiency would be little changed. For less than 450 or 400 the fire would probably have to be re-designed to maintain a similar efficiency. With the sacrifice of efficiency to speed, the practical effect was not much different, because a lower efficiency caused by higher speed would generally mean a saving in money by saving of time. Mr. Bath had mentioned a practical efficiency. Thermal efficiency meant not just reducing the quantity of gas used, but, by better design, gaining a higher heating standard for practical purposes, with due regard to the economical aspect. Mr. Whimster referred to insulation of settings. One of the benefits of this particular type was that it enabled thinner walls to be used. The alternative method of calculation which Mr. Nicholls had discussed was an intricate method, and he had chosen the simpler. He was prepared to reply to this and to other questions in writing.

Mr. N. REID (Gateshead) proposed, and Mr. T. C. WHIMSTER (Spennymoor) seconded, a vote of thanks to the author.

Mr. R. W. COPELAND (Newcastle) moved a vote of thanks to the Chairman, Committee, and Secretary.

Mr. W. E. OULDS (North Shields), seconding, said that he would like to stress the considerable amount of work which Mr. A. H. Bagshaw (Hon. Secretary) had done during the past year to the undoubted benefit and success of the Auxiliary Section.

The meeting concluded with tea, served in the Gas Offices.

Wales and Monmouthshire Junior Gas Association

A Meeting of the Association was held at the Offices of the Cardiff Gas Light and Coke Company on Saturday, Nov. 21—Mr. S. E. BRETT, the President, in the chair.

HEAT LOSSES FROM GAS OVENS.

By W. E. BENTON, M.Sc., of the Research Department, Cannon Iron Foundries, Ltd.

[EXTRACTED.]

After describing the standard methods of testing gas ovens recommended by the Institution of Gas Engineers, the lecturer continued: The Gas Industry is now faced with serious competition from electricity. When electricity cost 2d. or more per unit for heating and cooking, even an inefficient gas oven could show lower running costs than the best electrical cooker, but at a halfpenny a unit (as is already prevalent in several districts) efficiency becomes a deciding factor. Added to this one has the usual propaganda regarding "poisonous" products of combustion in contact with food, dangers of explosion, &c. Dismissing these I want to direct your attention primarily to the usual question of our electrical friends: "How can a gas oven possibly be efficient when it has to get rid of its products of combustion?"

ELEMENTARY THEORY.

When an oven is heated from cold the heat supplied by the burners may be divided into three parts:

(1) That used to raise the temperature of the ironwork and atmosphere of the oven.
(2) That lost by penetration through the sides.
(3) That which leaves the flue outlet with the products of combustion and excess air.

For any given rate of heat supplied, a temperature can be found at which the heat input is just sufficient to make good the losses through walls and flue. If the heat input is steady, the temperature will therefore also become steady. If T be this temperature, and τ be the external temperature, we have:

$$T - \tau = \theta_f$$

where θ_f is the final temperature difference. Now if Q be the gas rate, and C the gross calorific value, QC is the gross heat supplied by the burners in unit time. Therefore, in a small element of time δt, an amount of heat $QC\delta t$ enters the oven.

From a great many tests it was observed that in all well-constructed ovens the mean oven temperature never differs by more than about 4° Fahr. from the C.b.2. temperature at the oven centre. The following theory rests on the assumption that one can consider the oven as having a temperature equal at any moment to that at the oven centre.

When the oven temperature is increasing, part of the heat will go to raise the temperature by a small amount $\delta\theta$. Let us group the whole mass of the oven and its atmosphere into one mass m, of specific heat s, or, if you like, into one water equivalent ms. Then the heat used in raising the temperature during δt is $ms\delta\theta$. Now another part of the heat escapes with the products of combustion and excess air. Let us assume that the total volume passing through the oven is some multiple a of the gas rate—*i.e.*, Qa in unit time. Assume that this gaseous mixture has a mean density ρ, and a specific heat σ. Then the heat removed in unit time from the oven with the products is $Qa\rho\sigma\theta$, where θ is the temperature increase. Now in order to simplify the argument we will for the moment assume that the oven is perfectly packed—*i.e.*, no heat is lost through the walls.

The results of this assumption are somewhat surprising. We have:

Heat entering oven = heat remaining in oven + heat leaving oven.

$$i.e.,\ QC\delta t = ms\delta\theta + Qa\rho\sigma\theta\delta t$$

$$i.e.,\ \frac{d\theta}{dt} = \frac{QC}{ms} - \frac{Qa\rho\sigma}{ms}\theta \quad \ldots \quad \text{Eq. (1)}$$

Now $\frac{d\theta}{dt}$ is the rate of rise of temperature with time. When the temperature becomes steady this will be zero, and $\theta = \theta_f$

$$\text{Hence, when } \frac{d\theta}{dt} = 0,\ \frac{QC}{ms} = \frac{Qa\rho\sigma}{ms}\theta_f$$

$$i.e.\ \theta_f = \frac{C}{a\rho\sigma} \quad \ldots \quad \text{Eq. (2)}$$

This surprising result would appear to show that in a perfectly packed oven the temperature would not depend on the consumption, but solely on the ratio of the calorific value of one cubic foot of gas to the water equivalent of the products and excess air resulting from its combustion. Equation (1) can also be written:

$$\frac{d\theta}{dt} = \frac{QC}{ms}\left(1 - \frac{a\rho\sigma}{C}\theta\right) \quad \ldots \quad \text{Eq. (3)}$$

i.e., when $\frac{d\theta}{dt} = 0$, $Q = 0$ is also a solution.

That is, in a perfectly lagged oven an infinitely small supply of heat will maintain any requisite temperature.

Imagine an oven with very heavily lagged walls. Then one can see that a minute gas-flame would be sufficient to keep the temperature constant, and hence a minute volume of products would be produced, requiring an extremely small flue for ventilation. There is one condition attached to these results—namely, that the temperature of the oven should not of itself give rise to an aerodynamic force tending to ventilate the oven, a condition which limits us to the consideration of ovens with bottom flues.

We therefore see that, whereas the question of our electrical friends calls up a mental picture of a large and inevitable wastage of heat, the truth is that *if we lost no heat through the walls, we should lose none through the flue*, and only as lagging is diminished does the flue loss rise. If efficiency is going to be a deciding factor, then we must be prepared to use more lagging.

General Equation of Heat-Balance.

Now let us consider a bottom-flue oven heated to a uniform temperature-difference θ by means of suitable burners. If the walls are lagged, the temperature of the exterior surfaces will never be very high, so that we may assume as a first approximation that the loss of heat per unit area is proportional to the temperature-difference θ. If A be the total superficial area of the oven, the rate of loss of heat will be $KA\theta$, where K is a constant dependent on the conductivity and thickness of lagging. The equation of heat gains and losses is therefore:

$$QC\delta t = ms\delta\theta + KA\theta\delta t + Q_{ap\sigma}\theta\delta t$$

$$i.e.,\ \frac{d\theta}{dt} = \frac{QC}{ms} - \frac{Q_{ap\sigma} + KA}{ms} \quad \text{Eq. (4)}$$

which gives on integration:

$$\theta = \frac{QC}{Q_{ap\sigma} + AK} - \frac{QC}{Q_{ap\sigma} + AK}\, e^{-\frac{Q_{ap\sigma} + AK}{ms}\, t} \quad \text{Eq. (5)}$$

The exponential term diminishes rapidly as t increases, becoming zero when t is infinite. Hence the steady temperature is given by:

$$\theta_f = \frac{QC}{Q_{ap\sigma} + AK} \quad \text{Eq. (6)}$$

$$\text{when } t = O,\ e^{-\frac{Q_{ap\sigma} + AK}{ms}\, t} = e^{\circ} = 1.$$

Hence, when $t = O$, $\theta = O$, which shows that the initial conditions are correctly represented.

Now $\frac{d\theta}{dt} = g$, the temperature gradient.

When $t = O$, $\theta = O$, $g = g_o$, and from Eq. (4),

$$g_o = \frac{QC}{ms} \quad \text{Eq. (7)}$$

This is self-evident. In the first few moments of heating from cold, all the heat is used for heating the oven; none is lost through the walls or flue.

By substitution we therefore have:

$$\frac{d\theta}{dt} = g_o\,(1 - \theta/\theta_f) \quad \text{Eq. (8)}$$

$$\text{and } \theta = \theta_f\left(1 - e^{-\frac{g_o}{\theta_f}\, t}\right) \quad \text{Eq. (9)}$$

The accuracy, or otherwise, of these equations can easily be tested. When an oven is heated from cold, a curve can be plotted of temperature against time. If the theory is true these curves should have an exponential character, and from the first few minutes of heating it should be possible to predict the final temperature at which the oven will become stable. From Eq. (9),

$$\text{when } t = \theta_f/g_o,\ \theta = \theta_f\left(1 - \frac{1}{e}\right)$$

$$= \frac{2{\cdot}718 - 1}{2{\cdot}718}\,\theta_f$$

$$= 0{\cdot}633\,\theta_f$$

At this point

$$t = \theta_f/g_o,\ \theta = 0{\cdot}633\,\theta_f$$

$$i.e.,\ \theta/t = 0{\cdot}633\,g_o.$$

Therefore, if one were to draw a tangent to the curve at the origin and also a line through the origin having a gradient 0·633 of that of the tangent, cutting the curve at some point P, then a line through P parallel to the temperature axis would cut the tangent at a point corresponding to the steady temperature θ_f. Similarly:

$$\text{When } t = \theta_f/2g_o,\ \theta/t = 0{\cdot}786\,g_o$$

$$\text{and } \theta = 0{\cdot}393\,\theta_f$$

$$\text{And when } t = \frac{2\theta_f}{g_o},\ \theta/t = 0{\cdot}432\,g_o$$

$$\text{and } \theta = 0{\cdot}864\,\theta_f$$

Further it is known that if two heating-up tests are made with the same oven, one with and one without the gates and grid shelves (fig. 1), all other conditions being the same, the curves obtained are quite different, although

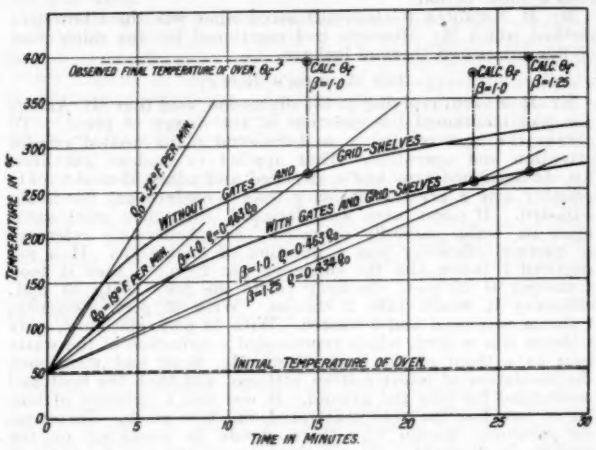

Fig. 1.

leading to the same final temperature. The calculated values of θ_f, however, should be independent of this circumstance.

The conclusions drawn from a great many tests made on these lines are as follows:

1. For the point $t = \theta_f/2g_o$ $\theta = 0{\cdot}393\theta_f$ which is fairly close to the origin, values of θ_f are obtained which agree to within 20° Fahr. of the observed temperatures. Experiments made with and without gates and grid shelves also agree with each other to about the same limits of accuracy.
2. For the point $t = \theta_f/g_o$, $\theta = 0{\cdot}633\,\theta_f$ which occurs some 15 to 30 minutes after commencement, the correspondence is poor, the calculated values of θ_f being always considerably less than those observed. In some tests this divergence is as much as 100° Fahr.
3. The point $t = 2\theta_f/g_o$ $\theta = 0{\cdot}864\theta_f$ is too remote from the origin to be of much practical value. The agreement is, however, in general, rather better than at $t = \theta_f/g_o$.
4. In all cases g_o must be taken as the mean gradient over the first three minutes, and not the instantaneous initial gradient.

A Closer Approximation.

The results of the theory outlined above seemed to indicate that a rapid series of heating-up tests, lasting ten or fifteen minutes each, at low consumptions, might give in three hours reasonably accurate information otherwise only obtainable in two days' work. A thermo-couple mounted from the base at the oven centre would dispense with any necessity to drill the oven door. The only precaution necessary would be that the oven should be thoroughly cooled between successive tests.

This method has been tried in our laboratories with considerable success. After heating for fifteen minutes, the oven is carried outside to cool for twenty minutes, during which time the calculations of the previous test can be worked out. Alternatively a second oven can be tested while the oven is cooling. In this way two ovens can be tested in three hours.

It was first of all necessary, however, to correct the theory in order that the theoretical and experimental curves should accurately agree. In Fig. 2 are shown three curves:

(1) An experimental heating-up curve.

(2) The curve according to Equation (9), constructed from the observed values of θ_f and g_o.

(3) The curve as obtained from the corrected theory using the same data.

You will see that although the curves (1) and (2) agree fairly well during the first few minutes, there is subsequently a very considerable divergence, the experimental curve being below that predicted by theory. This means that the temperature is rising less rapidly, or heat is being lost more rapidly, than the theory predicts. Since the same final temperature is ultimately obtained one cannot assume a greater loss of heat; it would appear that more heat is being stored in the ironwork and lagging than had

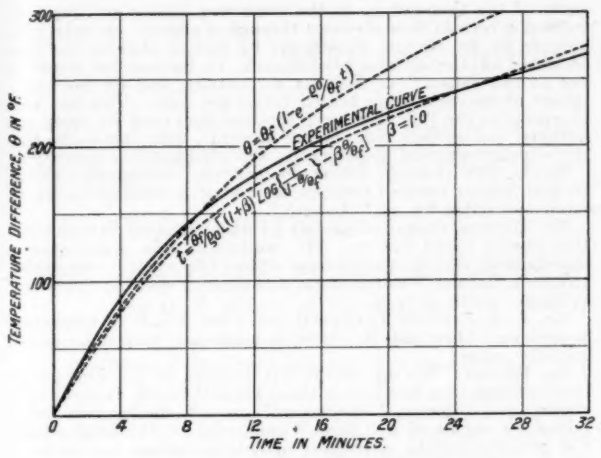

Fig. 2.

been supposed. We therefore look for an explanation in the gradual heating-up of the thicker parts of the ironwork and also of the lagging of the walls.

Let us assume that of the total mass, a part m_1 heats instantaneously—*i.e.*, its temperature is always coincident with that of the oven centre—and that the remainder heats gradually, the total "effective" mass, m, at any moment depending on the temperature. We will assume, therefore, that:

$$m = m_1\left(1 + \beta\frac{\theta}{\theta_t}\right), \text{ where } \beta \text{ is a fraction.}$$

Equation (7) then becomes:

$$g_0 = \frac{QC}{m_1 s} \quad \ldots\ldots\ldots \text{Eq. (10)}$$

and the differential equation (8) becomes:

$$\frac{d\theta}{dt} = \frac{QC}{m_1 s}\left\{\frac{1 - \theta/\theta_t}{1 + \beta\,\theta/\theta_t}\right\} \quad \ldots\ldots\ldots \text{Eq. (11)}$$

$$i.e.,\ t = \frac{\theta_t}{g_0}\left[(1+\beta)\log_e\left\{\frac{1}{1-\theta/\theta_t}\right\} - \beta\frac{\theta}{\theta_t}\right] \quad \ldots\ldots \text{Eq. (12)}$$

This equation is not very convenient to use, but gives a very good approximation to the experimental curve. Test-points can be selected in the following ways:

(1) When $\left(\frac{1}{1-\theta/\theta_t}\right) = e$, $\theta = 0{\cdot}633\,\theta_t$

and $t = \frac{\theta_t}{g_0}\left[1 + \beta - 0{\cdot}633\beta\right] = \frac{\theta_t}{g_0}\left[1 + 0{\cdot}367\,\beta\right]$

$i.e.,\ \frac{\theta}{t} = \frac{0{\cdot}633}{1 + 0{\cdot}367\,\beta}\,g_0$

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(2) When $\left(\frac{1}{1-\theta/\theta_t}\right) = \sqrt{e}$, $\log_e\left(\frac{1}{1-\theta/\theta_t}\right) = \frac{1}{2}$

and $\theta = 0{\cdot}393\,\theta_t$

Then $t = \frac{\theta_t}{g_0}\left[\frac{1+\beta}{2} - 0{\cdot}393\,\beta\right]$

and $\frac{\theta}{t} = \left\{\frac{0{\cdot}787}{1 + 0{\cdot}213\,\beta}\right\}g_0$

At first sight these points appear to be useless owing to lack of knowledge regarding β. It has been found, however, that for small domestic gas ovens having enamelled sheet-iron linings, one may fairly safely assume that half the mass is "accessible" and half "latent." That is, β has the value 1·0. A number of tests have shown that this is true of ovens of this type when tested without gates and grid-shelves. The presence of the latter appears to increase β to about 1·25, in the case of cast-iron gates; less with sheet-iron gates. We then have two points on the curve:

(1) When $\theta/t = 0{\cdot}463\,g_0$, $\theta = 0{\cdot}633\,\theta_t$
(2) When $\theta/t = 0{\cdot}649 g_0$, $\theta = 0{\cdot}393\,\theta_t$

Given an experimental curve, therefore, one has only to draw a line through the origin at a gradient 0·463 times the initial gradient, to cut the curve at a temperature which will be 0·633 times the final temperature increase, or alternatively, a line through the origin at 0·649 times the initial gradient will intersect the curve at 0·393 times the final temperature increase. As before, g_0 represents the mean initial gradient over the first three minutes.

Table I. will illustrate the variation of the test-gradient with the value of β. A large variation in β produces a relatively small change in the test-gradient, which tends to explain the good agreement between experiment and theory which has been obtained with ovens of different size and kind, using the arbitrary assumption that $\beta = 1{\cdot}0$ in every case.

Table I

θ	β	θ/t
$0{\cdot}633\,\theta_f$	0·75	$0{\cdot}496\,g_0$
	1·00	$0{\cdot}463\,g_0$
	1·25	$0{\cdot}434\,g_0$
$0{\cdot}393\,\theta_f$	0·75	$0{\cdot}679\,g_0$
	1·00	$0{\cdot}649\,g_0$
	1·25	$0{\cdot}622\,g_0$

In Table II. are shown typical results obtained with a small packed oven, one set of results being obtained by means of a few quick heating-up tests, and the other by the standard method involving nearly two days' work. In fig. 1 is shown the graphical determination of θ_f from two curves, corresponding to the same consumption, one with and one without gates and grid shelves.

Table II

Cambridge M.72 Oven	B.Th.U./hr.	Standard Test. θ_f obs.	θ_f calc. β=1·0	θ_f calc. β=1·25
With Gates and Grid-Shelves	2280	212	191	207
	2470	227	208	220
	3180	276	262	274
	4140	337	316	332
	4250	345	327	345
	4880	383	379	397
	5025	392	386	407
Without Gates and Grid Shelves	2290	212	191	——
	2440	224	226	——
	3110	272	264	——
	3600	305	303	——
	4140	337	335	——
	4220	343	344	——
	4965	386	394	——

Limitations to the Application of the Theory.

It will be seen that the application of the theory is limited by the following conditions:

(1) The C.b.2 temperature must approximate very closely to the mean temperature of the oven.
(2) The oven must have a bottom flue of some form, and must not be fitted with any thermostatic control of the flue opening.
(3) The products leaving the burners must not immediately impinge on the thermometer. Few ovens, however, are ruled out by this condition, as the tests are made at low consumptions.
(4) This rapid method of determining the maintenance efficiency does not supplant the standard test, but only serves to discriminate quickly between efficient and inefficient ovens. The standard test affords an abundance of other information which this test cannot give.
(5) The test takes no account of the exterior finish of the oven. In some extreme cases this would invalidate the conclusions.

I would again emphasize that while the theory appears to throw some light on the mechanism of the heating of gas-ovens, and definitely dispels the general belief that a gas oven is a crude device having no reliable scientific properties, it only represents a first approximation to the facts, and with the aid of more experimental data it should be possible to re-cast it into more accurate form.

Initial Gradient.

We have seen that, theoretically:

$$\left[\frac{d\theta}{dt}\right]_{t=0} = g_0 = \frac{QC}{m_1 s}$$

That is:

(1) The initial gradient should be proportional to the B.Th.U. rate.
(2) It should be possible to calculate the "accessible" water equivalent of the oven.
(3) Tests made with and without gates and grid shelves, at different gas rates, should give gradients having the same ratio.

These conclusions are borne out fairly well by experiment. The initial gradient is found to be proportional to the B.Th.U. rate except at very low consumptions—*e.g.*, 3 to 4 c.ft. per hour. The water-equivalent is easily calculated—*e.g.*, in the Cambridge K.72 oven, the "accessible" water-equivalent is about 2 lbs. without, and 3½ lbs. with, gates and grid-shelves.

The actual weight of the gates and grid-shelves amounts to 11 lbs. of iron, having an approximate water-equivalent of 1¼ lbs.

Conductivity.

We have: $\theta_t = \dfrac{QC}{Q\rho\sigma + AK}$

When $Q \longrightarrow 0$, $\theta_t \longrightarrow \dfrac{QC}{AK}$

Now in an efficiency test, the steady temperature increase θ_t is plotted against the B.Th.U. per hour per sq. ft. of cooking space, giving a curve from which is obtained the B.Th.U. per sq. ft. per hour required for an increase of 350° Fahr. Now the above equation shows that the initial gradient of this curve

$$\frac{1}{A}\left[\frac{d\ (\text{B.Th.U. per hour})}{d\,\theta_t}\right]_{Q \to 0} = \text{K, the conductivity factor.}$$

This has obviously very important applications, as it enables one to obtain an actual figure for the conductivity of the walls of a gas oven, from a standard maintenance test.

Conclusion.

A gas oven, when properly made, has definite scientific properties that can be accurately measured. In the first few minutes of heating an oven up from cold one can predict from the observed curve the steady temperature which the oven will attain in two hours' time. If efficiency is to be the deciding factor against electrical competition, we must pay more attention to lagging. Contrary to the views usually expressed, there is no theoretical limit to the efficiency of a gas oven. The theory outlined in this paper affords a means of obtaining the maintenance efficiencies of two ovens within three hours, to a reasonable degree of accuracy. From the theory one can calculate the actual values of the conductivity of the oven walls and the water equivalent of the oven. The theory, while only an approximation to the truth, offers some interpretation of the behaviour of gas ovens under various conditions.

Discussion.

Mr. Kelvin Jones asked if any improvement could be made in the method of lagging. Was it possible to make use of any of the principles employed in a vacuum flask?

Mr. Benton: We have not yet found any practical substitute for slag wool. The theory described in the paper indicates, however, that we must be prepared to use a greater thickness. A coal fired oven has recently been introduced by a Swedish inventor which has about 6 in. of lagging, and shows astonishing economies in fuel consumption. It would appear to be impossible to apply the vacuum principle itself to a gas oven, but it may be possible to make use of polished surfaces.

Mr. W. G. Biggins (Newport) said that with the automatically controlled oven he had received a few complaints of the food being burnt, although the thermostat had been set at the proper mark on the chart. Did the calorific value of the gas affect the oven temperature? What was the cause of condensate troubles continually found with bottom-flue ovens?

Mr. Benton: The temperature maintained by the thermostat is affected by changes in pressure, density, and calorific value;* of these pressure and density are the more serious. A change from 20/tenths to 60/tenths usually produces an increase of temperature of about ·5 of a mark at mark 1, and nearly 1 mark at mark 7. This is not a fault, but an inherent property of the thermostat, in the same way that a ball-tap controlling a certain flow of water through a cistern can only compensate for an increase in pressure by raising slightly the level of water in the cistern. Condensate in bottom-flue ovens is due to two causes: (1) Smaller air change, and (2) the atmosphere of the oven being heated before the sides. This has been overcome in the "Cambridge" (bottom-flue) oven by using two burners, one on each side, facing upwards, with the result that the sides are warmed immediately, and condensate is prevented.

Mr. L. Cox (Cardiff) asked whether the consumption should be still further reduced towards the end of a cooking operation, when controlled by an "Autimo."

Mr. Benton showed diagrams of the variation in consumption during bread baking. He emphasized the importance of maintaining the requisite temperature. It was no use trying to save a farthing's worth of gas and thereby spoiling five or ten shillings' worth of food.

Mr. J. H. Canning (Newport) asked for details of laboratory procedure. How did Mr. Benton allow for variations in the calorific value?

Mr. Benton: We use two 12 c.ft. holders for all short-period tests. These are filled at a time when the C.V. is steady, as shown by a "Sigma" instrument, the C.V. being then determined by means of a "Boys" connected to the holder inlet. For prolonged tests, a number of determinations are made on the Boys throughout the tests.

Mr. R. Mills (Cardiff) said that movable gates in an oven were unsightly and difficult to clean. Could not the runners be fixed to the cooker sides?

Mr. Benton pointed out that a certain amount of circulation space must be allowed in an oven, and with movable gates this was conveniently provided behind them. With runners on the linings the consumer was tempted to use tins of too great a size.

Mr. Mills said that the door latch on many cookers tended to become loose after a short time.

Mr. Benton: We endeavour to provide a latch which will fasten the door without the necessity to turn the knob. Our experience is that this form of latch is popular and satisfactory in use. Undoubtedly a tighter closure could be obtained by some means entailing a lever or rotating knob, but such a door would not fasten automatically when closed.

Mr. C. S. Thane (Newport) suggested that a groove filled with packing material might be inserted round the door frame, in order to give a tighter closure.

Mr. Benton said that such a device would mean making a door as a "coved" casting—a very expensive operation. He was glad to have this opportunity of explaining some of the difficulties attending the manufacture of gas stoves.

Mr. H. S. Bartlett (Cardiff) said that he had been very interested in the paper submitted by Mr. Benton. Their electrical competitors were inclined to stress the point of oven cooking, and claimed less shrinkage of meat than in a gas oven. The loss, it was understood, only represented moisture or water, but he asked the author what was a true statement of fact in favour of the advantages of gas.

Mr. Benton: There is no advantage in cooking meat in an electric oven. The question is purely one of personal taste. Probably the "driest" method of cooking meat is on a "spit," and many generations have been very satisfied with meat cooked in that way. The "Cambridge" (bottom-flue) oven gives rather more fat and gravy with the meat than did the "Challenge" (top-flue) oven, but the difference can be entirely eliminated by sealing the meat in a high temperature at the start. Dough baked in a "Challenge" oven loses slightly more weight than when baked in a coal-fired bakers' oven, but the result is unquestionably better tasting. The claim by the electricity interests is merely another instance of rather unscrupulous advertising. There seems to be a misconception in some parts of the Gas Industry that gas-appliance makers are not really interested in gas, but would just as readily make electrical appliances. Speaking for the Cannon Iron Foundries, I would say that there is no truth in this belief. We make no electrical appliances of any kind, and anything that affects gas also affects us. We are anxious to assist the extension of gas sales to the utmost possible extent.

Mr. B. J. Bell rose to propose a vote of thanks to Mr. Benton for his address, and said it was a valuable contribution which would be made full use of in the laboratory of his undertaking. The mathematical side would also be given careful consideration. There was at present, he thought, closer co-operation between the manufacturers and the undertakings, which was all to the good, and the appliances sent out had reached a high degree of efficiency. A great indebtedness was due to men like Mr. Benton for producing apparatus on scientific lines.

Mr. A. E. Pask (Caldicot), in seconding the vote of thanks, said that Mr. Benton certainly deserved their thanks for his paper. He was pleased to observe the greater efforts on the part of the makers to place appliances on the market which were attractive.

Mr. C. S. Thane (Newport) supported the motion.

The President announced two new members as follows: Mr. S. G. Parsons (Swansea) and Mr. Wilfred Pope (Associate Member) (Porth).

* See proceedings, Junior Gas Associations, 1930-31, "Theory of Thermostatic Control of Gas Ovens," by W. E. Benton.

Midland Junior Gas Association

Mr. W. L. S. Spinks presided at a meeting of the Midland Junior Gas Association at the Council House, Birmingham, on Thursday, Nov. 12, there being a good attendance of members.

LEAKS IN VERTICAL RETORTS: THEIR TREATMENT BY HOT PATCHING.

By D. J. WARD, of Birmingham.

[Abstract of a Thesis for which the Author was awarded a Diploma of the Institution of Gas Engineers.]

The retort plant referred to in this paper consists of 5-ton Woodall-Duckham continuous vertical retorts arranged in beds of four, there being one internal producer to each bed, eleven such beds constituting a range.

Spraying of leaky retort faces with suitable cement mixed to a thin grout was tried for the purpose of stopping holes in the brickwork, but unless these were of the smallest character, this practice was found useless, because, first, it is dangerous to spray cold grout on to red hot silica for the necessary length of time; secondly, much of the retort face which is not of a leaky nature is necessarily sprayed; and thirdly, it is difficult to work with a grout of suitable thickness, on account of pipe and spray blockage.

Hot patching by means of guns was next resorted to, the cement being "shot" into the leaks by the compressed air from the discharge of a blank cartridge carried in a suitable holder or gun supported by a ½-in. pipe. This was found slow and uncertain, as the cartridge was fired by the heat of the retort, which varied considerably, according to the height up from the bottom at which the leak was situated. Next the cement gun was tested. This consisted of an ordinary rifle stock carrying a long barrel, to the end of which was fixed a specially shaped discharge end. This was an improvement on the former type, as the pulling of a trigger exploded the cartridge, and thus the exact time of discharge of the cement was known. Even this was not deemed sufficiently speedy, so a compressed air gun was designed. This was found to be both quick and effective.

The gun consists of a 6 ft. length of ½ in. internal diameter weldless mild-steel tube, to the top of which is brazed a ½-in. W.I. short piece carrying a ½-in. gunmetal union. To the latter is connected a ½-in. bend, a ½ in. to ¾ in. increasing socket, a ¾-in. short piece, and finally a ¾ in. to 2 in. increasing socket. All the W.I. fittings are of the best steam pipe quality. By means of an ordinary bayonet joint, the gun fits on to the gun stand, which is 12 ft. overall, made of steel tube of ½-in. internal diameter, its bottom section carrying a ½-in. W.I. tee piece, to which is connected a ½ in. bend, 1 ft. 6 in. of ½-in. pipe, and a ½-in. G.M. union carrying a ½-in. short piece. Compressed air at 40 lbs. per sq. in. pressure is delivered to this short piece by 10 ft. of ¾-in. rubber hose from the operating table. This latter is equipped with a Bourdon pressure gauge reading to 100 lbs. per sq. in., a ¾-in. operating gland plug cock, and a relief valve, the whole being connected by 60 ft. of ¾-in. hose to the compressed air supply. The hoses are wired on in each case, to prevent any possible blowing off from the metal pipes.

The compressed air is supplied by a Belliss & Morcom air compressor situated in the exhauster house, and ¾-in. services are fixed along each side of each range of retorts, with suitable points for connection to the flexible pipe.

With this arrangement, any retort in the house may be hot patched at short notice, the moving of the guns and tackle and the fixing up of the operating table being a short procedure, connection being made to the nearest ¾-in. compressed air service, all the latter terminating with ¾-in. wheel valves carrying ¾-in. short pieces to allow of this.

To obviate the taking-off of the retort manlid each time a retort is "shot," the standard Woodall-Duckham pattern retort manlid was altered, by cutting out a 6 in. by 6 in. aperture in the centre of the lid, and fitting a small 9½ in. by 8½ in. C.I. cover carrying the centre bottom rodding hole. Thus, to prepare a retort for "shooting," all that has to be done is to undo the four ½-in. nuts carrying the small lid, and remove the latter, the guns being introduced into and withdrawn from the retort through the 6 in. by 6 in. aperture.

A gun team consists of three men, whose duties are as follows. No. 1 does the actual "shooting," No. 2 hands No. 1 the loaded guns, and turns the operating valve each time it is required to discharge a gun, while No. 3 loads the guns, of which the most convenient number for a team to handle is eight. The guns, on withdrawal from the retort, are cooled by immersion in a 7 ft. long trough of water, while the loading is carried out on two trestles, to one of which is fixed a 2-in. vice. A gun is charged by fixing it in the vice, undoing the union, inserting there a 1¼-in. diameter asbestos wad, fastening on the gun end again, and feeding into this about 3 oz. of the patching cement used. A little shaking is found necessary to ensure the cement reaching the wad, this being done to allow of a good, clean "shot," and to prevent any possible air bubbles in the charge. For charging, an ordinary tablespoon is used, one-and-a-half spoonfuls being sufficient.

For each "shot," No. 1 introduces the gun into the retort, fits it on to the gun stand by means of the bayonet joint, raises the whole, and presses the open gun end against the wall of the retort where the leak is situated. On his shouting "Right," No. 2 turns the operating valve through a half-circle, thus opening and closing it; the gun is discharged, lowered, disconnected, and exchanged for a loaded one, the empty gun being cooled and re-loaded. The above routine, when strictly adhered to, occupies, on the average, 45 to 50 seconds, depending on the accessibility of the leak, and its height up the retort.

Depending on atmospheric conditions, and the location of the retort for repair, the temperature in which No. 1 of the team operates varies considerably, but usually he can "shoot" for 15 minutes without undue discomfort. After this period he makes way for No. 2, he himself taking over the duties of No. 3, the latter occupying the position vacated by No. 2. In this way, the patching is continuous, and the retort can be coked up again and put to work after the shortest possible delay due to the repairs.

Under normal conditions, it takes about two hours for the CO pressure to dissipate, this dissipation being natural as the bed is under pressure (*i.e.*, the dampers to the main flue are shut), and hence primary air gradually ceases entering through the producer doors, this causing a cessation of the production of CO. After about an hour with the dampers at "normal" again, CO pressure may again be put on the retort under repair.

The following are details of repair to a retort, patched until tight, the leaks being average both as regards number and position.

CO pressure put on, and patching started	10 a.m.
" " dissipated and dampers put to normal positions	12 mid-day
" " put on again	2 p.m.
Patching finished and retort tight	3 p.m.
And coked up by	4 p.m.

Number of "shots" put in, 200 in 3 hours. Average, 67 per hour.
Weight of cement used, 38 lbs.
Actual time coking up of retort was delayed by patching = 6 hours.

The above repair, everything being included, cost approximately £1 16s.

REQUIREMENTS OF A HOT PATCHING CEMENT.

1. Adherence to the hot silica.
2. Resistance to abrasion and possible removal by the moving charge.
3. Fairly slow setting in air, to allow of easy working.
4. Expansion in the leak to ensure a sound patch. Grade "A" cement of the following analysis was found best for all purposes.

Analysis.	P.Ct.	*Screenings.*	
SiO_2	60·0	All passes	1/100 in. mesh
Bauxite grog	38·2	" "	1/10 " "
Vegetable glue	1·0	All remains on	1/20 " "
CaO	0·8		
	100·0		

For use in the guns it is mixed with sodium silicate (water glass) in the proportions 100:1, the mixing being done by working 3 oz. of the water glass in solution into a 20-lb. bucket of the cement, the whole being used fairly wet.

CONSIDERATION OF COSTS.

HOT PATCHING *v.* COLD REPAIR.

Hot patching cannot be considered as a definite or permanent cure for leaks in vertical retorts. Its usefulness depends on the extra time it will keep retorts in good condition before the inevitable letting down for cold repair and pointing. This may be taken as 12 or 14 months. Therefore, to get a fair estimate of the relative costs, cold

repair alone must be taken as against cold repair combined with hot patching. A period of six years has been taken, at the end of which time the retorts would be in approximately the same condition.

(*a*) *Hot Patching and Cold Repair.*

Retorts work one year without any repair, are hot patched for two years, and then let down for repair cold. This happens twice in the six years, when the retorts will again be due for cold repair.

(*b*) *Cold Repair.*

Retorts work for three periods of two consecutive years, being let down at the end of the second and fourth years. Thus, after six years, they will be in the same condition as in the previous consideration —*i.e.*, due for cold repair.

With 44 retorts in a range the costs work out as follows:

	£
Hot patching for 1 year	310
Each cold repair	1750
Period of Six Years.	
(*a*) Hot patching 4 years	1240
(*a*) Cold repair once	1750
Total	£2990
(*b*) Cold repair twice	3500

The annual saving in favour of (*a*) is:

Per 1000 c.ft.	0·037d.
Per therm	0·008d.

Annual saving in repairs bill £180.

Though the spraying of retort faces is not recommended as a good method of stopping leaks, except of the smallest kind, this practice must not be confused with those of glazing over new retort faces when cold, or spraying hot silica work with a thin cement, with a view to providing a hard wearing surface, which can be periodically renewed —*e.g.*, at each scaling time.

This latter is recommended, providing care is taken that the silica remains at red heat while it is being sprayed. If this is not done, and the silica is cooled to blackness, any beneficial effects are more than counteracted by damage due to local surface contraction and expansion.

When a new range of retorts is starting up, it is good practice to spray each retort as it goes down for scaling, and to continue this operation until leaks are suspected. (This should not be before 12 or 14 months' working.) Then pressure may be put on the doubtful retorts when they are empty, and, if necessary, any leaks may be stopped by "shooting," and the retort sprayed afterwards.

Spraying of retorts does not lengthen the scaling period, as the bottoms may be done the morning or afternoon of the day the retorts run empty, while the tops can be done just before coking up on the following day.

Usually, it is sufficient to spray to a depth of 7 ft. from the top of the retort, and 11 or 12 ft. up it from the bottom, but, if considered advisable, the intervening 5 or 6 ft. may be reached from the bottom by using an extension section on the usual length of pipe.

It is possible to stop leaks by spraying, but, as before mentioned, this should not be attempted unless the leaks are of the smallest character—*e.g.*, if a retort face is found to have many small leaks, "shooting" with a gun is a tedious business, and spraying for about 5 minutes at 2-hourly intervals may be resorted to until the leaks are stopped. A retort under CO pressure should never be sprayed, for obvious reasons.

To spray a retort, the pipe carrying a suitable spraying device is introduced through the bottom small lid, the pump started, and the spray allowed to play on one wall, being moved slowly along to the end, then along the adjoining wall, and so on back to the starting point, when it is moved higher up, and the same performance gone through until the bottom 12 ft. or so have been sprayed. In this way, each section of retort face is subjected to the spray for a few seconds only.

A suitable cement, which, mixed to the right consistency, gives no pipe blockage trouble, is Grade "B" Cement for spraying.

Under normal conditions two men will top and bottom spray a retort in two hours. The cost, including material and time, is 13s.

The conclusions arrived at are that hot patching will not permanently stop leaks, but so retards leakage as to enable retorts to run for 1 or 1½ years longer than if no patching were practised. Also, that hot patching should be used in conjunction with spraying and cold repair to keep refractory work in really good condition.

The possible harm done to beds of retorts by continually putting them under CO pressure is far outweighed by the benefits derived from hot patching.

Discussion.

Mr. W. MacNaughton (Wolverhampton), in moving a vote of thanks to Mr. Ward, said his paper was of a most informative and practical character. Leaks in vertical retorts were very prevalent, but he had noticed that in the North, where a non-caking coal was used, the life of the retort was materially longer than in the Midland area. In the North he estimated it at about five years, and in the Midlands about 2½ years. He would like to know whether in Mr. Ward's opinion there was less leakage with a 5-ton retort than with a 7-ton retort, and whether it was better to work the producer dry or wet. The question of critical temperatures when starting up was, in his opinion, one of importance, because the temperature in the brickwork was frequently quite different from that in the flues. It seemed to him that this matter was one worthy of further investigation. It appeared that there was less leakage where the corners were circular, as compared with square corners.

Mr. S. K. Hawthorn (Birmingham), in seconding, stressed the importance of adequate pressure being placed upon the retort when it was being tested. There should be a small current of air going up the retort. Many retorts were tested and passed as being tight when they were actually leaking, because small leaks often escaped notice during the working. With regard to the patching by shooting, it was important to bear in mind that the personal element entered very largely into such work. Leaks could be stopped quite satisfactorily by conscientious men, but those who did their work perfunctorily frequently failed. At Windsor Street, Birmingham, a system of spraying had been going on for about nine months—new work was also sprayed—and the leaks were practically negligible. The policy was to test every retort under pressure.

Mr. T. H. Poulson (Stafford) congratulated the author on the excellence of his contribution, and said the Junior Association had reason to be encouraged by the good standard of papers that were read at their meetings, and which frequently were of interest to the Gas Industry as a whole. He agreed that more work would have to be done with regard to the question of critical temperatures when retorts were dried out, and he would be interested to know whether Mr. Ward recommended the exclusion of excessive air when settings were being dried out. He was inclined to the view that, if they put the doors on and kept some of the air down, spalling would be reduced. He did not agree with the suggestion that had been made that the settings would last only 2½ years. At Stafford he estimated the life at about 1500 actual working days. He had wondered whether it was satisfactory to make repairs of this kind when the retorts were cold.

Mr. J. H. Wainwright (Halesowen) inquired if the author thought that, in the operation of horizontal retorts, shooting with an ordinary gun with compressed air would be satisfactory. Was spraying to be recommended when the retorts were new, prior to charging?

Mr. Shelley (Walsall) stated that they had had experience of hot patching at Walsall over a long period, and one of the difficulties which had arisen had been with regard to bunker fires caused by the hot gases after shooting. Another trouble following the shooting was that it was impossible for at least 24 hours to do anything with the retort because of the continued falling of scurf. Their experience was that it was more economical from the point of view of labour to carry out shooting in pairs of retorts at one time. He regarded Mr. Ward's methods as extremely satisfactory, but it seemed to him that success depended in very large measure upon the cement used. A good deal of cement would not stick where it was placed, and he was of opinion that further research work should be done on cements, because hardly a cement was effective.

Mr. R. L. Greaves (Wolverhampton) emphasized the importance of accurate analysis of the gases. On the question of critical temperatures he suggested that the increase in temperature must be regular throughout the whole period.

Mr. A. R. Myhill (Birmingham) said in his opinion it was of first importance that there should be a careful sampling not only of gases, but of coal and coke. In regard to producer gas, while a fairly constant supply was maintained, differences arose due to the period of time in which the producer had been clinkered. In his opinion, samples should be taken, if at all possible, over 24-hour periods. He would like to know if Mr. Ward had solved the troublesome question of the hydrocarbons in the gas. Considerable mischief could be done by careless workmen in the use of scurfing tools, where there had been much spalling, and some information as to the best kind of tools would be of interest.

Mr. Smith (Birmingham) pointed to the rapid changes of temperature which took place in silica work, and said he was never able personally to reconcile the spraying of cold water on silica surfaces.

The Author's Reply.

Mr. Ward acknowledged the vote of thanks, and, in referring to points raised in the discussion, said he agreed that leakages were aggravated by certain types of coal, and it was to be expected that there was less likelihood of leaks where non-caking coals were used. He could give no estimate of the comparative differences in leakage in five and seven ton retorts, because, as mentioned in the paper, the seven tonners at Windsor Street were not regularly hot patched on account of the difficulty of getting sufficient CO pressure on one retort without seriously affecting the other 15 retorts in the half range. This range of seven tonners was to be reconstructed in 1932. As to the working of producers, he thought it advisable to work with as dry an ash pan as possible. His experience with round and square cornered retorts was that the latter type was more

likely to show leaks, especially in the angles at the joints of the corner blocks. He agreed that successful shooting depended largely on the personal element, and every effort should be made to interest the men in their work.

As to the question of excessive air when drying out, he recommended that this should be avoided as far as possible, it being sufficient to leave producer doors ajar when a range was on slow fire.

Regarding shooting of horizontal retorts, he understood this had been the practice at many works having the modern 20 ft. "through" segmental retorts, a type of cartridge gun being used. E.B. Tamping Mixture was very suitable for hot patching, the analysis of which was given in the paper. Spraying could be indulged in on new retorts before being put to work, but usually it was commenced at the first scaling time.

Regarding fires in coal bunkers, these could be avoided by seeing that the coal slide was quite shut when the retort was down for scaling, and also that the coal drum was in the correct position. There should be an air space between the coal fender on top of the drum and the coal slide at the base of the coal hopper. Hydrocarbons in gas were taken as ethylene for calculation.

There was no danger in spraying the silica of retorts at scaling temperatures (say, 1000° to 1100° C.), if care were taken that the work was *always* red hot during the spraying. Scurfing tools should be used solely for easing loose scale from the retort walls, and not to chip it off, or damage to the brickwork would follow.

Cement for making the joints on new work should have as nearly as possible the same chemical composition as the silica bricks, to ensure equal expansion when working heats were obtained.

Yorkshire Junior Gas Association

Members of the Yorkshire Junior Gas Association met on Nov. 21 at Elland. During the afternoon a visit was paid to the works of the Elland-cum-Greetland Gas Company, where the party were welcomed by Mr. J. Bridge, Engineer and General Manager, and members of his staff, and were shown over the plant.

Subsequently the party adjourned to the Elland Liberal Club. According to the originally-planned programme, this should have been the day of the Presidential Address by Mr. J. W. Holroyd, but as Mr. Holroyd recently left Elland to take up the position of Distribution Superintendent to the Rotherham Gas Undertaking, President's Day has been postponed, and will be held at Rotherham in April. To fill the breach, Mr. A. W. Elliott, recently-appointed Assistant Engineer at Elland, had prepared at short notice a paper on "Continuous Carbonization: Some Notes on the Working and Maintenance of Vertical Retorts."

Mr. HOLROYD presided over the proceedings at the Liberal Club.

Mr. J. BRIDGE, offering a formal welcome to the meeting to Elland on behalf of his Directors and all at the Elland Works, said the Chairman of the Company, unable to be present himself, had asked that his congratulations should be conveyed to Mr. Holroyd, until lately one of the Elland staff, on his election to the Presidency of the Association. During Mr. Holroyd's terms as Junior and Senior Vice-President, they at Elland had been looking forward to having the President of the Yorkshire Junior Association on their staff, and they were quite disappointed to find that his elevation to that office almost synchronized with his removal to a new post in the larger town of Rotherham. They at Elland had had Mr. Holroyd for seven years, and they were well aware that he had set his successor a standard which would be no easy task to maintain. Speaking of standards of efficiency in the Industry, Mr. Bridge said he believed the whole level in the profession was being definitely raised by the work of such Associations and, latterly, by the training and examination scheme of the Institution of Gas Engineers.

The PRESIDENT, introducing Mr. Elliott, thanked Mr. Bridge for his kind remarks, and expressed his own good wishes to Mr. Elliott and his own successor on the distribution side at Elland. Mr. Elliott was a newcomer to the Association, and he (Mr. Holroyd) owed him special thanks for the manner in which he had, at short notice, stepped into the breach by the preparation of that day's paper. He wished also to give him a hearty welcome to Yorkshire on behalf of the Association.

CONTINUOUS CARBONIZATION.

WORKING AND MAINTENANCE OF VERTICAL RETORTS.

By A. W. ELLIOTT, Assistant Engineer and Manager, Elland-cum-Greetland Gas Company.

[ABSTRACT.]

The object of this paper is to deal with some of the minor points which assist in the successful everyday working, of vertical retorts. The paper mainly refers to the plant at the Shrewsbury Gas-Works. It comprises three beds of four Dempster-Toogood vertical retorts, of a nominal capacity 62,500 c.ft. of gas per day, served by coal breaker, elevator and push plate conveyor, and coke grading plant. The waste gases from the setting were passed through a Spencer-Bonecourt waste-heat boiler.

The setting was put to work in 1921, and at the time of the commencement of these observations, November, 1929, one bed had been completely rebuilt in the summer of 1928, and the other two repaired in the summer of 1929. Of the two beds repaired, the upper 12 ft. and the lower 2 ft. were rebuilt, the remainder being original brickwork which is still in use to this day. The material is, top 4 ft. 6 in. Allen's Chamotte (aluminous), next 6 ft. Oughtibridge 95 p.ct. silica, and the remaining 13 ft. Morton's C.O. (siliceous) material.

HEATING THE RETORTS.

A good producer gas was best achieved by reducing the draught on the fire to give approximately atmospheric pressure in the producer gas flues supplying the burner nostrils, working with the furnace doors open, and restricting the supply of water and steam to a minimum, consistent with keeping the firebars relatively cool. A steady draught produced by the waste-heat boiler turbine fan made the regulation of the draught on the setting an easy matter, and undoubtedly was an important factor in the maintenance of a constant supply of primary air.

These conditions resulted in the production of a gas of good composition, having on the average 30 p.ct. of carbon monoxide. The higher temperature of the fuel bed, attained by the restriction of water, allowed a more complete reduction of the carbon dioxide, and ensured that the steam united with the coke giving the carbon monoxide and hydrogen reaction, and not carbon dioxide and hydrogen. The higher temperature of the fuel bed also favoured the production of methane.

It may seem that working the furnace at temperatures approaching 1000° C. would cause the formation of clinker and seriously shorten the life of furnace linings. Clinker troubles are practically unknown. Using unscreened coke of ash content 9 to 10 p.ct. in inclined screen-bar grates, pricking and shaking the fires once every four hours, kept them loose and free from large masses of clinker. Any clinker formed was shaken to the base of the furnace, whence it was easily removed.

It is an interesting coincidence that I should now be at Elland when mentioning the inclined screen bar grate, because that grate originated at Elland, Mr. Bridge, the present Engineer, being responsible for the introduction of the pioneer grate of this type.

It is quite conceivable that a large excess of water does much harm, for by reducing the temperature of the fuel bed the quality of producer gas is greatly impaired, and the action of the steam probably has just as injurious an effect on the linings as a temperature of 1000° C.

Even heating of the retorts is not necessarily accomplished by supplying a constant quality of good producer gas to the combustion chambers. Secondary air must be provided in sufficient quantity to ensure complete combustion without large excess.

STEAMING THE CHARGE.

Supplying a regular and easily controlled weight of steam to the retorts is a difficulty which arises on many vertical installations. Ordinary reducing valves, even if reliable at first, frequently become unsatisfactory and result in a fluctuating steam pressure which does not give the best steaming results. On this particular plant the exhaust steam from the waste-heat boiler turbine fan was discharged at a pressure of 25 lbs. per sq. in., maintained by a dead weight relief valve. This steam at low pressure was used for steaming the retorts and for pumps in the works.

The use of wet exhaust steam at 25 lbs. per sq. in., which had been supplied to the turbine at 120 lbs. per sq. in., made the usual tables and formulæ for calculation of discharge through nozzles unreliable. To determine exactly the quantity of steam admitted, the author had a fitting and nozzles, exactly like those in use, arranged to discharge from the steam supply to the retorts into a condenser, so that the weight of water could be collected and weighed. An air condenser, 80 ft. long, made of 2 in. wrought-iron pipe and terminating with a home-made copper Liebig condenser 3 ft. long, served to condense as much as 60 lbs. per hour. Numerous tests were made

using different steam pressures and different sizes of nozzles, the water collected over one hour being weighed and the results plotted in the form of a graph.

During the early part of 1930, great difficulty was experienced in keeping the coke customers supplied. In the winter time, the coal gas was supplemented by about 15 to 20 p.ct. of carburetted water gas of the same calorific value—460 B.Th.U. To increase the production of coke, the throughput of coal in the verticals was increased from 4·1 to 5·1 tons per retort per day, steaming was reduced, and the resulting gas averaged 485 B.Th.U. calorific value. This was diluted by making blue water gas with the water gas plant. Although the make per ton of coal gas was reduced from 19,500 to 16,900 c.ft., the thermal yield per retort was increased by 12½ p.ct. All oil and some coke were saved on the water gas plant, and the total make of coke was increased by nearly 25 p.ct.

Flexibility of Vertical Retorts.

It is interesting to consider how flexible the vertical retort is, producing gases of calorific value varying over quite a large range. As a contrast with the production of a high quality gas, the following are details relating to the practical manufacture of blue water gas in vertical retorts. Ragged scurf sometimes causes a retort to work badly, due to holding up of the charge. This makes the task of rodding very difficult and means that the stokers cannot keep to their time table. Moreover, the gas from such a retort is poor in quality and volume. Occasionally, when trouble of this nature was experienced with a retort which was not due for scurfing, it was the practice to check the control damper, stop the extractor, and allow the retort to "steam," the blue water gas formed leaving by the offtake pipe and mixing with the coal gas from the other retorts. The extractor was run for half-an-hour twice a shift, and the retort filled up with coke from the bunker. A retort worked in this way would produce 30,000 c.ft. per day of blue water gas of calorific value 300 B.Th.U., the labour spent being negligible. Often after steaming for two days, a retort would work on coal quite satisfactorily till it was due for scurfing. This practice of steaming was by no means a regular every day occurrence —only one retort at a time worked in this way, and the total days when a retort was steaming only amounted to about thirty during a year.

Size of Coal.

General inference from experience at Shrewsbury shows that results of carbonizing small sized coal are in accordance with the findings of the Fuel Research Department.

Peas and beans, although equally good in analysis to the larger nuts size, do not give such a good gaseous thermal yield. The small coal lies closer together, giving less free space for swelling and so offering more resistance in the top of the retort to the rising gas. This results in a greater pressure in the lower part of the retort and consequently a greater possibility of leakage. Also there is a prolonged contact of the gas with the hot walls of the retort, and degradation takes place. Less water gas must be produced by reduced steaming to dilute the poorer quality straight coal gas, if the quality of the gas made is to be kept up to the standard.

These statements seem to be substantiated by the following evidence. The standard of gaseous yield of over 19,000 c.ft. per ton was not maintained while the smaller coal was in use.

The gas analyses showed an increase in hydrogen content of 2 to 3 p.ct., while the hydrocarbons, methane, and carbon monoxide were lower. More trouble was experienced from scurf formation in the retort, and from dry, pitchy deposits in the gas offtake pipes and hydraulic boxes.

Scurfing.

Owing to its greater heat conductivity, the use of silica material for retort construction has resulted in higher temperatures in the interior of the retort, and incidentally permitted the safe use of still higher combustion chamber temperatures. Higher makes of gas per retort and per ton were undoubtedly assisted by the use of silica at Shrewsbury, but the increased amount of scurf formed by the employment of a higher temperature in the retort reduced the period between scurfing from six to four weeks.

The loss of gas during the extra two days required for scurfing a retort in every twelve weeks was more than compensated for by the additional gas made while the retort was at work, as the make of gas per retort per day increased from about 65,000 to 80,000 c.ft.

In connection with scurfing it was found that, while the carbon burned off readily at the sides, it was thicker and took much longer to remove from the ends of the retort. Unless the retort temperature is reduced considerably the rapid combustion of the carbon on the sides overheats the surface of the silica blocks and the unequal expansion of the carbon and the silica causes flaking off of small pieces of silica, which could be found in the dust and cleanings from the extractor tray.

In order to keep some check on the rate of combustion of the side carbon, and at the same time to accelerate the combustion of the end carbon, the air for scurfing was restricted at the bottom of the retort and an additional supply introduced from the top for the end carbon. A supply of air from the smithy fan was run into the retort house, and distributed by means of the wrought iron hand railings. Temporary flexible connections were made to adjustable ¾ in. pipes, which led the air down the retorts, and, by means of a bend at the end, allowed a current of hot air to impinge on the carbon where it was thickest. The use of this device saves 12 hours in the scurfing period, and allows a retort to be gasmaking again in 48 hours.

Some Home Repairs.

The condition of a retort setting is often judged by the appearance of the retorts themselves and of the producer lining. Yet even if these are in good order, endless trouble can be experienced through faulty fluework, which escapes the general examination of the setting.

During the winter 1929-30, some cases of coal gas leakage into the heating flues were discovered in the lower half of the retorts which were built in 1921, and had not been renewed. In the following summer one bed at a time was cooled down, and trouble was found to be due in all cases to the failure of special blocks made with oval hollows on the flue side to allow for more conduction of heat. The blocks had become uniformly thin with the wearing action of the coke, and holes had developed, sometimes aided by cracking of the brickwork, where the depth of the oval hollow was greatest and the block consequently thinnest. The faulty work was cut out and retort walls rebuilt in tongued and grooved brickwork.

Trouble from the same cause, the hollowed blocks, was also discovered in the secondary air flues, which, as mentioned previously, rise vertically beside the waste gas flues, separated only by these hollowed blocks. In this case the blocks were hollowed on both sides, leaving the brickwork only 1 in. thick in places. They are consequently unable to withstand the expansion strains placed upon them when the setting is at work, and crack at the weakest place, allowing air to leak into the waste gas flues. This was first detected by comparison of analyses of the waste gases from top and bottom of the flues. There was an increase in the oxygen content of 6 p.ct., in some cases, representing about 30 p.ct. air leakage.

When the beds were cooled down, the secondary air flues were opened out where analysis revealed that short-circuiting had been taking place, and the division walls between the two flues were rebuilt in solid brickwork. Further tests after the retorts were working again showed the effectiveness of the repairs.

In their latest type of setting, of which there is one bed at Shrewsbury, the makers have discarded the hollowed blocks in the construction of both the retort walls and waste gas flues. The secondary air rises in tubes separated from the waste gas flues by solid brickwork. This bed has never given any indication of air leakage.

Repairs to steel platework on hoppers and elsewhere on coal handling plant have been performed by means of a small portable oxy-acetylene welding and cutting apparatus.

Discussion.

Mr. B. Thorpe (Huddersfield) asked what result Mr. Elliott obtained for waste gas analyses immediately below the chimney damper. He (Mr. Thorpe) had experienced short circuiting in the same type of setting and found in the region of 13 p.ct. carbon dioxide. In regard to scurfing, he remembered noticing some time last year that at a works in Scotland they had fitted a baffle plate down one side of the retort and a tall chimney at the other, to induce a current of air down one side and up the other. This arrangement reduced the time required for scurfing.

Mr. Elliott replied that on the plant he had described they could easily maintain 16 to 17 p.ct. of CO_2 at the waste-heat boiler inlet—which was equivalent to the chimney damper. He had tried baffles in the retort for getting the air just where it was wanted. He tried two long steel plates, one down each side and covering the centre part of the retort over at the top. The plates would be 8 ft. long, and the idea was to let the air come up the sides through a narrow channel; but he found the use of air pressure more satisfactory. These plates when they were hot were difficult to handle, and pipes and air blast were much easier and handier.

Mr. Blundstone (Dewsbury) said he had been interested in Mr. Elliott's remarks about the size of coal. He understood generally that the size of coal was a material factor in verticals. In Yorkshire at present some in the Industry were experiencing considerable difficulty in getting the size of coal they would like. He wondered whether the increased gaseous yield from good coal might weigh against its higher price. So far as con-

cerned horizontals, at any rate, he thought in these days, when the Industry was so much dependent on its primary product, it might pay to take cheaper grades of coal and depend for results on the primary product instead of bye-products.

Mr. ELLIOTT, in reply, said that owing to the distance from the coalfields, the price of coal into the works at Shrewsbury was relatively high. It was a matter of considerable importance to make as much gas from a ton of coal as possible, and to avoid paying carriage on ash. Owing to the demand for coke and the increasing gas output, they were extending the carbonizing plant, so that all gas required could be produced with a vertical installation.

Mr. J. B. BALMFORTH (Bingley) said he gathered the impression from the reading of the paper that in the Dempster-Toogood plant the coke and coal were fed into the retort through a common valve at the top, and that the stream could be divided at will. From that he presumed the two were fed simultaneously, which, of course, on most plants was not so. If he had gathered a correct impression, it would be interesting to know whether any trouble was experienced in the seating or the tightness of that valve.

Mr. ELLIOTT: It is a conical valve with a single opening, so that coal and coke cannot be fed at the same time. The opening has to be opposite either the coal bunker or the coke bunker when the valve is open, but it is possible to put in a little coke to fill the retort after a "drop," before the bin is filled with coal. The valve is eased or tightened according to the need, by a nut at the top. Sometimes there is trouble with sticking owing to the large surface contact, though that surface is useful for gas tightness.

In answer to a further question by Mr. Balmforth as to whether the abrasion of the coke tended to wear away the valve and seat, Mr. Elliott said that in 1929 there was a little grooving around some of the valves. They were taken out and turned true again on the lathe. The effect, however, was not serious, as might be judged from the fact that the valves seen at the Elland Works that day were the original valves put in in 1914, so that it would be seen that their life was considerable.

Mr. F. FIRTH (Leeds), in regard to the increasing of coke production by making a higher calorific value gas and diluting it down by actual water gas instead of in the retort, said he was not quite clear how Mr. Elliott by this means increased the amount of coke he had available for the market.

Mr. ELLIOTT: The water gas plant is always working throughout the winter, so the coke used is not an additional drain. The high quality gas is an inevitable result of increasing the throughput. It cannot be done to run 5·1 tons per retort per day through the verticals and bring the quality down by internal steaming. The production of water gas in the vertical retort depends more than anything on a long contact of the steam with the hot coke, and by increasing the throughput the carbonizing zone was brought further down in the retort so reducing that body of hot coke. The water gas originally made was carburetted to bring it up to the same value as the vertical gas. Instead of using the carburetted water gas by mixing at the same calorific value, approximately the same quantity of blue water gas was used for diluting the coal gas. Thus practically all the extra coke made by increasing the coal throughput was available for sale.

Mr. FIRTH: How is coke saved on the water gas plant?

Mr. ELLIOTT: The make per retort increases from about 80,000 to 86,000 c.ft. per day, so less water gas is required; that is where the coke is saved.

Mr. FIRTH: Did you cut out the oil altogether?

Mr. ELLIOTT: Yes. The blue water gas is about 300 B.Th.U. calorific value.

Mr. HODGSON said he noticed that Mr. Elliott deviated a little from the original design of the producers by having a tendency towards open doors to admit more air. During the afternoon's visit he had noticed the same thing at the Elland Works. He wondered whether Mr. Elliott could give any figures as to the amount of coke worked out per ton of coal. It would be interesting if he could make any kind of comparison as against other types of continuous verticals.

Mr. ELLIOTT: The coke used as a percentage on the coal carbonized worked out at nearly 15 on a series of tests when the coal throughput was 4·1 tons; and that I think, bearing in mind the thermal yield from a ton of coal, gives quite a fair figure for verticals. With regard to producer practice, design and ideas about producers and working of settings have probably altered somewhat since the introduction of this design with closed doors. The quantity of primary air admitted at the Shrewsbury plant is controlled by draught on the setting, and by producer gas dampers.

Mr. J. W. WOOD, M.Sc., referring to the scurfing, wondered whether the introduction of the air under pressure from a ¾-in. pipe gave rise to any local overheating on the surface which might accentuate spalling effects. In regard to the admitting of steam to the retorts, Mr. Elliott had described quite an elaborate system. Even after calibrating the nozzles the introduction of steam could only be controlled by the use of a pressure gauge, but there was no indication of the steam pressure on the outlet side of the stopcock.

Mr. ELLIOTT: The air blast certainly does produce local heating. It happens on the end of the retorts. Any spalling I have seen has always been on the side walls and not on the end walls, so I do not think it is doing any harm. I should perhaps have mentioned in the paper that there is a pressure gauge, and also a chart which keeps a record of the pressure on the nozzles.

Mr. C. A. NEWHAM (Leeds) asked whether the effect of removing the carbon rapidly by the induced air would not tend to cause flaking or spalling.

Mr. ELLIOTT replied that the temperature of the carbon at the end during combustion with the air blast was not nearly so high as that of the incandescent carbon on the sides when precautions were not taken to reduce retort temperatures. He had not noticed any cases of silica being brought off through this method. There was more control over the combustion of the end carbon than over that of the side carbon.

Mr. FIRTH said his opinion was that spalling was the result of chemical action when the retort was at work, the results of which were only revealed at scurfing time. Referring to the open doors of the producer, he remarked that that meant an open firegrate. What precautions were taken to keep the girder, which formed part of the retort, cool? Normally, there was a circulation of primary air round the bottom of the retort which kept that girder cool, but apparently Mr. Elliott cut this out; and one would like to know whether he had any particular trouble in consequence, or what sort of cooling device was adopted without it.

Mr. ELLIOTT: The question of spalling is a very debatable one, and I don't intend to be in any way dogmatic; but the evidence I have seen leads me to believe that spalling does occur during scurfing time. Large pieces of carbon frequently come out with the coke while the retort is working, and I cannot remember ever having seen small pieces of silica fixed to one of them. I have, however, frequently seen pieces of silica adhering to carbon which has come out during scurfing time. Also, careful regulation of retort temperatures while scurfing definitely lessens the liability to spall. There is certainly a loss of cooling effect by admitting the primary air through the door instead of the air flues, but the plates have been taken from the ends of the old iron flues to allow free circulation of air, and at Elland steam jets have been fixed to allow increased draught if necessary. The box girder also receives considerable cooling from the secondary air.

Mr. BRIDGE said he wished to take the opportunity of congratulating Mr. Elliott on his first paper. He would like to invite every member of the Junior Association to emulate Mr. Elliott and make an early attempt at the production of a paper. They would all find it extremely beneficial to themselves to do so. At Shrewsbury, as shown by Mr. Elliott, they had found that a good coal produced a good coke which was an excellent fuel, finding a ready market for domestic purposes. At Elland they had consistently given special attention to coal. They had tested many coals—both those purchased under contract and others—over many years, and had acquired a great deal of valuable information therefrom. The result of it all was that they were now receiving all their coal from two collieries. One coal had under 4 p.ct. of ash and the other had under 2·5 p.ct., with the result that they produced a coke very low in ash content and excellent for domestic uses. Whereas years ago they used to have to export considerable quantities of their coke, for some years past now they had sold it all in their own district, and sometimes there was so big a demand for their coke for local domestic uses that the Company actually had to buy coke from neighbouring gas undertakings to use on their own works. For some time past, said Mr. Bridge, he had been doing a certain amount of experimenting with coke fires. Recently he had been experimenting with a grate made for him by Messrs. Wilsons and Mathiesons, Ltd., of Leeds. It was an excellent grate for burning coke. The bars were inclined as in the "Elland" screen bar grate, with the result that the coke lay on a nice slope, which allowed easy and perfect combustion. Three-halfpenny worth of gas per week in this grate was enough to light the fire every morning. The grate was easily adaptable to any existing fire, and was finished in the makers' well-known "Lexos" finish, which did not burn off with the heat of the fire. Mr. Bridge suggested that any man who wished to increase his knowledge of coke should try putting a coke fire in his own house.

Mr. WOOD, proposing a vote of thanks to Mr. Elliott, said from the paper given that day they would all realize the Yorkshire Junior Association had gained an acquisition in the coming of the new Assistant Engineer to Elland, and they hoped to see and hear a good deal of him in the future.

Mr. D. T. LIVESEY (Doncaster) seconded.

Mr. ELLIOTT, replying, said he considered the heartiness of the vote of thanks as part of his welcome to Yorkshire.

Mr. BALMFORTH, moving thanks to the Directors of the Elland-cum-Greetland Gas Company and Mr. Bridge for their hospitality, said he did so with particular interest because he began his own career at the Elland Works over thirty years ago, and he had since watched with pleasure the manner in which that works seemed to be a regular training ground for men going to high positions in the Industry in many parts of the country and abroad. The Elland Gas Company had always been a go-ahead concern, and as long as 25 years ago was one of the first undertakings to have an up-to-date showroom in the main street of the town.

Mr. FIRTH seconded the resolution.

Mr. BRIDGE, responding on behalf of his Directors and himself, said the Elland Works certainly seemed to be earning a reputation for producing good men. Only in the past year they had sent out three good men. Mr. Crowther (late Hon. Secretary of the Yorkshire Junior Association) had become Manager and Secretary at Rugeley. Then the Chief Showrooms Assistant left for a higher position with the larger gas undertaking at Birkenhead; and latest was the departure of Mr. Holroyd, the Association's new President, from Elland to Rotherham.

GAS MARKETS & MANUFACTURES

Stock Market Report.

[For Stock and Share List, see later page.]

The wide fluctuations of the external value of the £ sterling caused renewed uneasiness in most markets on the Stock Exchange last week, but Mr. Chamberlain's reassuring statement in the House of Commons, coupled with the opinions expressed in other well-informed circles, brought about a return to confidence. The liquidation which was so marked during the previous week eased up and markets became fairly firm, though the volume of business was on a limited scale. Some weakness in British Funds was attributed to Continental selling and unfounded rumours of "inflation," but a satisfactory feature was the report that a large number of buying orders had been booked for these securities on behalf of private investors.

In common with other markets, the volume of business in Gas stocks and shares was somewhat curtailed last week, and it will be seen from the Stock and Share List that the quotations of some of the leading securities weakened slightly. Gas Light units dropped a further 3d. to 18s. 3d., and South Metropolitan ordinary fell 1 point to 99½, while (at the local Exchange) Bristol 5 p.ct. maximum lost 2½ points to 89. A few debentures were also adversely affected. These small depreciations at the present time can only be attributed to a preponderance of selling inquiries on the part of those investors who, in order to find funds to satisfy the almost unprecedentedly high tax demands shortly due, may be forced to liquidate part at least of their holdings. When, however, this liability has been met and the date for dividend disbursements draws nearer, it is anticipated that prices will show improvement.

The Directors of the Plymouth and Stonehouse Company have recommended interim dividends at the rates of 4 p.ct. on the ordinary stock, 6¾ p.ct. on the additional shares, and 6½ p.ct. on the new shares, all of which are at the same rates as a year ago. The ordinary stock is now quoted at 112½, and the yield on the basis of last year's dividend (8 p.ct.) works out at £7 2s. 2d. The issue, however, is a comparatively small one, and the stock being rarely available (the last recorded transaction on the London Exchange was in August last at 111¾) largely accounts for the present low price. Another interim dividend announcement is that of the Malta and Mediterranean Gas Company, Ltd., which is distributing 5 p.ct., free of tax, on the £5 ordinary shares. This is also at the same rate as for the corresponding period.

Current Sales of Gas Products.

The London Market for Tar and Tar Products.

LONDON, *Dec.* 7.

The values of tar products remain unchanged and are as follows:

Pitch is from 65s. to 70s. per ton f.o.b.

Creosote, for export, varies from 3¾d. to 5d. per gallon f.o.b., according to specification.

Pure toluole is firm at about 2s. 5d. to 2s. 6d. per gallon; benzole is 1s. 8d. to 1s. 9d. per gallon; 95/160 solvent naphtha, about 1s. 5d. to 1s. 6d. per gallon; and pyridine bases, 3s. 9d. to 4s. per gallon.

Tar Products in the Provinces.

Dec. 7.

The average prices of gas-works products during the week were: Gas-works tar, 22s. to 26s. Pitch—East Coast, 55s. to 56s. f.o.b. West Coast—Manchester, Liverpool, Clyde, 55s. to 56s. f.o.b.* Toluole, naked, North, 1s. 8d. to 1s. 8½d. Coal-tar crude naphtha, in bulk, North, 5d. to 5¼d. Solvent naphtha, naked, North, 1s. 3d. to 1s. 3½d. Heavy naphtha, North, 11d. to 11½d. Creosote, *ex* works, in bulk, North, liquid and salty, 3¼d. to 3½d.; low gravity, 1¼d.; Scotland, 3¼d. to 3½d. Heavy oils, in bulk, North, 5d. to 5½d. Carbolic acid, 60's, 1s. 6½d. to 1s. 7d. Naphthalene, £9 to £10. Salts, 50s. to 70s., bags included. Anthracene, "A" quality, 2½d. per minimum 40 p.ct., purely nominal; "B" quality, unsaleable.

* All prices for pitch are now quoted on the basis of f.o.b. In order to arrive at the f.a.s. value at any port it will be necessary to deduct the loading costs and the tolls whatever they may be.

Tar Products in Scotland.

GLASGOW, *Dec.* 5.

While prices remain firm in this area there is not much new business being arranged. Stocks of most products continue low and forward offers are difficult to secure.

Pitch.—The export price remains nominal at about 60s. per ton f.o.b. Glasgow, while for home trade 60s. to 62s. 6d. per ton *ex* works is being obtained.

Refined tar to Ministry of Transport Specification continues in fair demand at 4d. to 4¼d. per gallon *ex* makers' works in buyers' packages.

Creosote.—Production at this season is at its lowest, and prices therefore are steady. B.E.S.A. Specification is 2¾d. to 3d. per gallon; low gravity, 3¼d. to 3½d. per gallon; and neutral oil, 3¼d. to 3½d. per gallon—all f.o.r. works in bulk.

Cresylic acid.—Orders are difficult to secure, and quotations are irregular. Pale, 97/99 p.ct., is 1s. 2½d. to 1s. 3½d. per gallon; dark, 97/99 p.ct., 1s. 1½d. to 1s. 2½d. per gallon; and pale, 99/100 p.ct., 1s. 4½d. to 1s. 5½d. per gallon—all f.o.r. naked.

Crude naphtha.—Value is steady at about 4½d. to 5d. per gallon, according to quality.

Solvent naphtha.—Stocks are accumulating, and prices are more or less nominal at 1s. 3d. to 1s. 4d. per gallon for 90/160 grade, and 1s. to 1s. 1d. per gallon for 90/190 grade.

Motor benzole remains dull at 1s. 3d. to 1s. 4d. per gallon f.o.r. in buyers' rail tanks.

Pyridines.—90/160 grade is 3s. to 3s. 3d. per gallon, and 90/140 grade 3s. 3d. to 3s. 6d. per gallon.

Benzole Prices.

These are considered to be the market prices for benzole at the present time:

	s.	d.		s.	d.	
Crude benzole	0	7	to	0	7½	per gallon at works
Motor "	1	2	"	1	3	" " "
Pure "	1	6	"	1	7	" " "

Parliamentary Intelligence

[From Our Special Correspondents.]

House of Lords.

Private Bill.

The Kilmarnock Gas Provisional Order Bill has passed its third reading without amendment, and is awaiting the Royal Assent.

Special Orders.

The following Special Orders, having passed the Special Orders Committee, have been approved by the House, and are waiting the Affirmative Resolution: Gosport and District; Walton-on-Thames and Weybridge; Berkhampstead; Gloucester (No. 1); Cannock and District; Rhyl; Skegness; Wantage; Newquay (Cornwall); and Hornsey.

In the case of the Goucester (No. 2) Order the Board of Trade proposed a modification, which was recommended by the Special Orders Committee and approved by the House. The modification is in clause 5, to leave out "Directors" and insert "Company."

In the case of the Luton Order the Board of Trade proposed an addition, which was recommended by the Special Orders Committee, and approved by the House. The addition is in clause 73, to insert: "Provided that the powers of this section shall not be exercised in regard to any street belonging to a railway company except with the consent of that company, but such consent shall not be unreasonably withheld nor shall the Company in carrying out any works authorized by this section unreasonably obstruct or interfere with the access to any such street."

House of Commons.

Special Orders.

The following Special Orders have been approved by the House: Coatbridge Gas Company; Walton-on-Thames and Weybridge; Gosport District Gas Company.

STOCK AND SHARE LIST.

[For Stock Market Report, see earlier pages.]

Issue.	Share.	When ex-Dividend.	Dividends. Prev. Hf. Yr.	Dividends. Last Hf. Yr.	NAME.	Quotations. Dec. 5. (Provincial Exchanges Dec. 4.)	Rise or Fall on Week.	Transactions. Lowest and Highest Prices During the Week.
£			% p.a.	% p.a.				
1,551,868	Stk.	Oct. 5	7½	7½	Alliance & Dublin Ord. ...	100—105	...	103—104½
374,000	,,	July 9	4	4	Do. 4 p.c. Deb.	67—72	...	75⅛⅜
522,655	,,	Aug. 24	7	7	Barnet Ord. 7 p.c.	120—125	—1	123—123½
300,000	1	Oct. 19	1/9½	1/4½	Bombay, Ltd.	15/—17/6	...	15/1½
174,500	10	Aug. 10	9	9	Bournemouth 5 p.c. ...	14⅜—15⅜	...	...
500,050	10	,,	7	7	Do. B 7 p.c. ...	12—13	...	12½—12⅞
439,160	10	,,	6	6	Do. Pref. 6 p.c. ...	10½—11½	...	...
50,000	Stk.	June 25	3	3	Do. 3 p.c. Deb. ...	55—60	...	...
162,025	,,	,,	4	4	Do. 4 p.c. Deb. ...	75—80	...	76—76½
357,900	,,	Aug. 24	7½	7½	Brighton & Hove 6 p.c. Con.	114—119	...	...
371,880	,,	,,	6½	6½	Do. 5 p.c. Con.	104—107	...	105½—106½
1,287,500	,,	July 23	5	5	Bristol 5 p.c. max.	88—90[a]	—2½	...
120,420	,,	June 25	4	4	Do. 1st 4 p.c. Deb. ...	78—80[a]	...	...
217,870	,,	,,	4	4	Do. 2nd 4 p.c. Deb. ...	78—80[a]	...	...
328,790	,,	,,	5	5	Do. 5 p.c. Deb.	98½—99½[a]	...	...
855,000	,,	Oct. 5	8	7	British Ord.	108—113	...	...
100,000	,,	June 25	7	7	Do. 7 p.c. Pref.	110—115	...	...
120,000	,,	,,	4	4	Do. 4 p.c. Red. Deb. ...	70—75	...	...
450,000	,,	,,	5	5	Do. 5 p.c. Red. Deb. ...	92—97	...	...
160,000	,,	June 25	5	5	Cambridge 5 p.c. Deb. ...	92—97	...	...
100,000	10	Nov. 30	8	6	Cape Town, Ltd.	8⅞—9⅛[a]	—¼	...
100,000	10	Oct. 30	4½	4½	Do. 4½ p.c. Pref. ...	6¼—7¼	...	...
150,000	Stk.	June 25	4½	4½	Do. 4½ p.c. Deb. ...	65—70	...	69—70
626,860	,,	July 23	6	6	Cardiff Con. Ord.	95—98	...	...
237,860	,,	June 25	—	2½	Do. 5 p.c. Red. Deb.	90—95	...	...
167,150	,,	Aug. 10	6⅛	5	Chester 5 p.c. Ord.	86—91[b]	...	...
98,936	1	Oct. 5	1/-	2/-	Colombo, Ltd. Ord.... ...	27/—32/-	...	30/—30/9
24,500	1	,,	1/4¼	1/4¼	Do. 7 p.c. Pref.	17/—19/-	...	...
609,204	1	Oct. 19	1/3·27	1/0·90	Colonial Gas Assn. Ltd. Ord.	10/—15/-	...	...
296,053	1	,,	1/5·67	1/2·54	Do. 8 p.c. Pref.	10/—15/-	...	...
2,078,280	Stk.	July 23	6	6	Commercial Ord.	92—95	...	...
475,000	,,	June 11	3	3	Do. 3 p.c. Deb. ...	52—57	...	...
787,560	,,	Aug. 10	7	7	Croydon sliding scale ...	107—110	...	...
459,100	,,	,,	5	5	Do. max. div.	81—84	...	83—84
542,270	,,	Aug. 24	10	7	Derby Con.	120—125[c]	...	...
55,000	,,	June 25	4	4	Do. Deb.	65—70[c]	...	...
209,000	,,	Sept. 7	5	5	East Hull Ord. 5 p.c. ...	71—76	...	...
1,002,180	,,	Sept. 21	16½	14	European, Ltd.	100—110	...	99¼—107½
18,958,038	,,	July 23	5⅝	5⅝	Gas Light & Coke 4 p.c. Ord.	17/9—18/9[f]	—/3	17/9—18/6
2,600,000	,,	,,	3⅜	3⅜	Do. 3⅜ p.c. max.	55—60	...	56—58⅜
4,294,691	,,	,,	4	4	Do. 4 p.c. Con. Pref. ...	70—75	—3	72½—75
5,594,095	,,	June 11	3	3	Do. 3 p.c. Con. Deb. ...	53—58	—2	53⅜—57
3,642,770	,,	,,	5	5	Do. 5 p.c. Red. Deb. ...	95—100	—1	99—100½
2,500,000	,,	,,	—	4½	Do. 4½ p.c. Red. Deb. ...	91—94	...	89—93
161,480	,,	Sept. 7	10	10	Harrogate Cons. 10 p.c. max.	157—162	...	...
82,500	,,	Aug. 24	7	7	Hastings & St. L. 5 p.c. Conv.	95—100	...	...
258,740	,,	,,	5⅛	5⅛	Do. 3⅛ p.c. Conv.	80—85	...	...
70,000	10	9 Oct. '30	⅛	10	Hongkong & China, Ltd. ...	12½—13¼	...	...
213,200	Stk.	Aug. 10	6	6	Hornsey Con. 3½ p.c. ...	89—92	...	...
2,800,000	,,	Oct. 30	25	15	Imperial Continental Cap.	70—75	...	...
223,130	,,	Aug. 10	3½	3½	Do. 3½ p.c. Red. Deb.	129—132	...	...
235,242	,,	Aug. 10	8½	8½	Lea Bridge 5 p.c. Ord. ...	96—97[b]	...	...
2,145,907	,,	Aug. 24	6	6	Liverpool 5 p.c. Ord. ...	79—81[b]	...	...
306,083	,,	July 15	4	4	Do. 4 p.c. Deb. ...	123—128	...	...
165,736	,,	Aug. 24	9	8	Maidstone 5 p.c. Cap. ...	55—60	...	...
63,480	,,	June 25	3	3	Do. 3 p.c. Deb. ...	64—7[c]	—½	...
75,000	5	Nov. 30	110	110	Malta & Mediterranean ...			
392,000	—	Oct. 1	5½	5½	Metropolitan (of Melbourne) 5½ p.c. Red. Deb.	78—83	...	...
171,978	Stk.	Aug. 24	5	5	M. S. D. Utility "C." Cons.	76—81	...	...
522,992	,,	,,	4	4	Do. 4 p.c. Cons. Pref.	67—72	...	...
675,000	,,	May 21	16	16	Montevideo, Ltd.	70—80	...	...
2,051,315	,,	Aug. 10	5½	5	Newcastle & Gateshead Con.	15/6—16/6[d/]	...	...
682,856	,,	,,	4	4	Do. 4 p.c. Pref. ...	68—70[d]	...	...
691,705	,,	June 25	3½	3½	Do. 3½ p.c. Deb. ...	69—71[d]	...	...
277,285	,,	Oct. 30	5	5	Do. 5 p.c. Red. Deb.	96—98[d]	...	...
199,940	,,	Aug. 24	7½	7½	North Middlesex 6 p.c. Con.	105—110	...	...
896,160	,,	Aug. 10	5	5	Northampton 5 p.c. max. ...	74—79	...	...
300,000	,,	Nov. 30	7	9	Oriental, Ltd.	90—100[b]	—3	...
60,000	5	13 May, '15	—	—	Ottoman	0—¼	...	...
205,162	Stk.	June 25	8	8	Plym'th & Stonehouse 5 p.c.	110—115	...	...
424,416	,,	Aug. 24	8	8	Portsm'th Con. Stk. 4 p.c. Std.	119—124	...	...
241,446	,,	,,	5	5	Do. 5 p.c. max. ...	76—79	...	...
686,312	,,	July 23	4	4	Primitiva 4 p.c. Rd. Db. 1911	83—86	...	...
389,813	,,	June 25	4	4	Do. 4 p.c. Cons. Deb.	84—87	...	85—86
150,000	10	Sept. 21	6	6	San Paulo 6 p.c. Pref. ...	7½—8	...	...
1,736,368	Stk.	Sept. 7	6½	6	Sheffield Cons.	103—105[e]	...	...
95,000	,,	July 9	4	4	Do. 4 p.c. Deb.	79—81[e]	...	...
138,301	,,	Sept. 7	5	8½	Shrewsbury 5 p.c. Ord. ...	72—77	...	...
90,000	10	June 11	15	15	South African	3½—5½	...	...
6,709,895	Stk.	July 23	7½	8	South Met. Ord.	98—101	—1	98½—100
1,135,812	,,	,,	6	6	Do. 6 p.c. Irred. Pf.	103—108	...	104½—107
1,895,445	,,	July 9	3	3	Do. 3 p.c. Deb. ...	53—58	—3	54½—56
1,000,000	,,	July 23	4	5	Do. 5 p.c. Red. Deb.	95—100	...	96—98
91,500	,,	Aug. 10	8½	8½	South Shields Con.	108—110[f]	...	...
1,543,795	,,	Aug. 10	6½	6½	South Suburban Ord. 5 p.c.	101—104	...	101½
668,337	,,	June 25	5	5	Do. 5 p.c. Deb.	92—97	...	...
647,740	,,	Aug. 24	5	5	Southampt'n Ord. 5 p.c. max.	76—79	...	...
121,275	,,	June 25	4	4	Do. 4 p.c. Deb.	70—75	...	...
250,000	,,	Aug. 24	7	7	Swansea 7 p.c. Red. Pref. ...	96—99	...	...
200,000	,,	June 25	6½	6½	Do. 6½ p.c. Red. Deb.	99—102	...	...
1,076,490	,,	Aug. 10	6⅝	6⅝	Tottenham and District Ord.	103—107	...	...
150,000	,,	,,	5½	5½	Do. 5½ p.c. Pref. ...	93—98	...	...
199,005	,,	June 11	4	4	Do. 4 p.c. Deb. ...	70—75	...	...
85,701	,,	Sept. 21	6	6	Tuscan, Ltd., 6 p.c. Red. Db.	72—77	...	...
310,694	,,	Aug. 24	7	7	Uxbridge, Maidenhead, & Wycombe 5 p.c.	100—105	...	...
88,330	,,	,,	5	5	Do. 5 p.c. Pref. ...	85—90	...	...
1,322,220	,,	July 9	7	7	Wandsworth and District: Consolidated	111—114	...	111½
971,373	,,	,,	5	5	Do. 5 p.c. Pref.	90—95	...	...
1,167,964	,,	June 25	5	5	Do. 5 p.c. Deb.	94—99	...	...

Quotations at:—*a.*—Bristol. *b.*—Liverpool. *c.*—Nottingham. *d.*—Newcastle. *e.*—Sheffield. *f.*—The quotation is per £1 of stock. * Ex. div. Paid free of income-tax. ‡ For year. ½ Div. = 10 p.ct. p.a. less tax and less tax on interim dividend.

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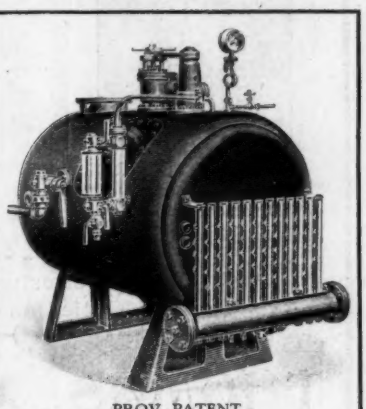

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CONTENTS

EDITORIAL NOTES.

A GLANCE AT THE CONTENTS . . . 715
A Terrible Experience 716
A Quality Product 716
An Amalgamation Bill 717
A Novel Competition 717
A Lengthy Audit 717

CORRESPONDENCE.

Gas Dehydration by the Glycerin Process . 718
Refrigeration 718
Low-Temperature Carbonization 718

Personal 718
Forthcoming Engagements 719

NEWS OF THE WEEK.

Paragraphs 719
Unnecessary Public Expenditure 719
Presentation to Mr. Henry Gage 719
National Gas Council—Meeting of Central Executive Board 720
Gas Exhibition at Oldbury 720
A Jubilee Celebration—The Fifty Years of Messrs. William Sugg & Co., Ltd. . . . 720
Scottish Junior Gas Association (Eastern District) 721
Salford's Experiment in Creosote Oil Fuel for 'Buses 721
East Surrey Co-Partnership Progress . . 721
Nottingham Prices and Meter Rents . . 721
Burton Call in Expert 722

NEWS OF THE WEEK—(*continued*).

Improved Lighting of Todmorden . . . 722
Coventry Works Dispute—Men Resume Work 722
Manchester and District Junior Gas Association—
Visit to Lancashire Tar Distillers, Ltd. . 722

SPECIAL ARTICLES, &c.

Earthquake—Hawkes Bay, New Zealand. By Archibald Dougall 723
In Continental Countries—Abstract Translations from the Technical Press of France and Germany 726
Building a Gas-Works 727
Stockport's Progressive Gas Department . 728
Panel Heating for a Large Suite of Offices . 729
Autumn Beauty on the Gas-Works . . . 729
Nomogram for Reduction of Gas Volumes to 30 in. Pressure and 60° Fahr. By D. G. Bagg 731
Reviews 731
On the Electrical Side 732
New Showrooms at Stockport 733
Notes on Plants and Processes 733
Gas Firing of Pottery 740

"JOURNAL" TECHNICAL RECORD.

The Principles of Calculation of Low-Temperature Radiant Heating. By A. H. Barker, B.A., B.Sc. 734
Scottish Junior Gas Association (Western District)—
Visit to the Edinburgh Works of Messrs. Thomas Glover & Co., Ltd. 735
The Making of Dry Gas Meters. By A. W. Sharman 735
Institute of Fuel—
The Commercial Evaluation of Coke. By R. A. Mott, M.Sc., F.I.C. 737

REGISTER OF PATENTS.

Carburetted Water Gas—Humphreys & Glasgow, Ltd. 741
Lubrication of Guide Rollers—R. & J. Dempster, Ltd., and Walker, L. J. L. 741
Heating Stoves—Rutten, J. 741
Gas Ignition Devices—Horstmann, F. O., Horstmann, J. H. G., and the Horstmann Gear Company, Ltd. 741
Prepayment Mechanism—South Metropolitan Gas Company, Hart, C. A., and Coleman, E. 741

LEGAL INTELLIGENCE.

£650 Compensation for Man's Death at Gas-Works 741

MISCELLANEOUS.

Parliamentary Intelligence 741
Trade Notes 742
Gas Acts (1920 and 1929) Orders 742

GAS MARKETS AND MANUFACTURES.

Stock Market Report 742
Current Sales of Gas Products 742
New Capital Issues 742

Stock and Share List 743

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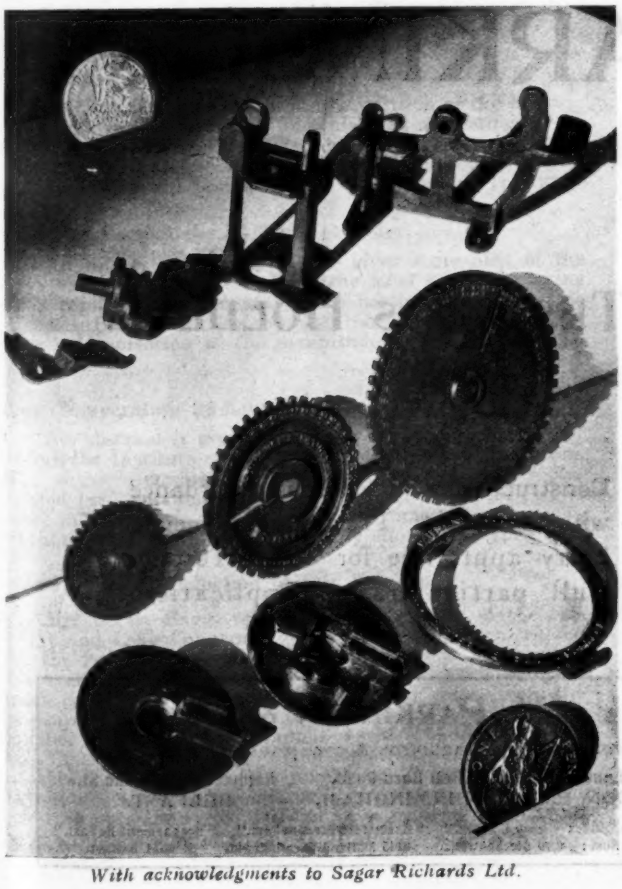

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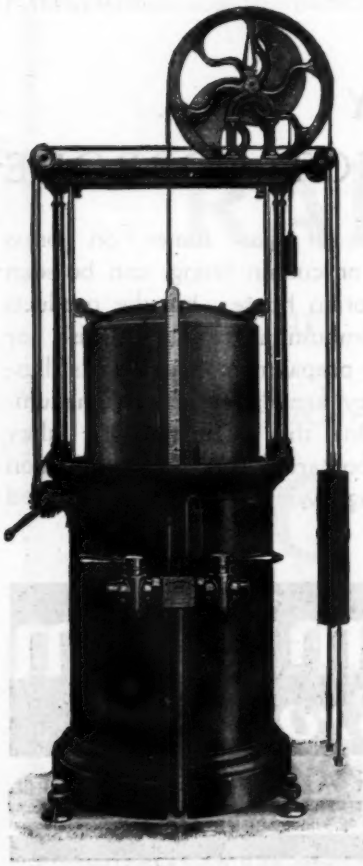

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